ON LONGEVITY AND MEANS FOR

THE PROLONGATION OF LIFE

FOUNDED ON A LECTURE DELIVERED BEFORE THE ROYAL COLLEGE OF
PHYSICIANS ON DECEMBER 3RD, 1903

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FIFTH ENLARGED EDITION, REVISED AND PARTLY REWRITTEN

*Work, Moderation and Contentedness are the main sources of health,
happiness and long life*

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The Fifth Edition of my father's book was already set up in type at the time of his death (November 11, 1918); as editor I have really had practically no more to do than correct the proofs. Sir Clifford Allbutt, an old friend of my father, kindly undertook to write the preface. All that my father left in that regard was the following note: "It may perhaps seem to many that I have dwelled too long on the various forms of exercise, and also on the psychic and moral elements in their connection with health and longevity, but I hope to be pardoned on account of the great importance of the subjects."

London,
February, 1919.

F. PARKES WEBER.

PREFACE TO THE FIFTH EDITION.

Dr. Parkes Weber has conferred a privilege upon me by his invitation to write a foreword to the Fifth Edition of my late dear friend his father's treatise on *The Prolongation of Life*, a privilege which I much value. I am glad to think and to hope that my sorry bush may serve at least as a signal of the good wine within.

Sir Hermann Weber wrote this book as much for the lay as for the medical reader; its learning is lightly carried, its style is easy, and has that contemplative and autobiographical touch which wins its way to the heart of the reader. Longevity is indeed the subject of the book, but we should do it an injustice were we to regard it as no more than a bid for length of days; as but a method of eluding those loving gods who might desire to take us back to their company too soon. But the more impressive part of the treatise is that, older or younger, we should live healthier and more wholesome and thus more beneficent lives. If, without too sordidly hour by hour calculating our physiological cash, we can form habits of temperance, economy of energy, regulated outward conditions, equanimity and unselfishness, the main staple of our lives will wear better; and, whether longer or shorter, do more useful service for our fellow creatures.

I should be a poor courier were I to try here to anticipate the descriptions and counsels of the author; his lively lessons on air, exercise, diet, housing, climate, and habits; morals—the hygiene of the mind—not being forgotten. He is, as we should expect, an eloquent witness to the virtues of fresh air and mountaineering. Some years ago, but Sir Hermann may then have been nearer eighty than seventy years old, three or four of us were climbing some steepish bit of a mountain in Central Europe, when a youngster of our party said to him: "Sir Hermann, you have done a good deal of this sort of thing in your time." "In my time, Sir! my time is now." To the end he was vigorous in both body and mind. All through this book the author plumps for walking as on the whole the best exercise for health. Perhaps it is, if the conscientious walks can have some pleasant conditions, and diversions of mind. Some of us may prefer a horse or a bicycle, unless the walk can be among the hills. To me highways on foot are, I admit, abominable, especially when the walk gives itself the airs of a duty. However this discussion can have but a temporary value; the fashion for motoring will soon reduce our legs to the rudimentary hind limbs of the whale. As regards the author's advice on gymnastics, I would warn elderly persons—say over 60—that, by such efforts, unless very carefully moderated, slight strains, hardly noticeable at the time, may become later the occasional seats of gouty or rheumatic disorder.

Although not totally an abstainer myself, I fully agree with Sir Hermann that on the whole, for the mountaineer or other sportsman, alcohol is bad. Years ago I urged this in *Murray's Guide to Switzerland*, when the doctrine was not so tolerable as it is now. The ruling principle is that whatever little alcohol be taken by the climber it should be taken only when the work is done—never during it. On the other hand, during excursions I strongly support, and I think most climbers would, the testimony of the author (p. 108) in favour of sugars—say in the form of prunes, raisins, chocolate and the like—an element of combustion perhaps too much depreciated by athletes and biochemists. The remarks on salt again are not to be overlooked. Let me also accentuate the warning not to eat a full meal, as one is sorely tempted to do, at the end of a fatiguing day. Let the sportsman be content with a bowl of hot bouillon at bedtime, and awake ravenous in the morning to dine at the breakfast table. To the injunction to take some regular exercise of both mind and body in daily life I also would add my testimony. Time after time we see the premature breakdown of persons, often townsmen, who had boasted of their independence of bodily exercise. Sir Hermann's claims for fresh air in rooms and balconies will nowadays be readily granted ; and his hint of the capabilities of the roof reminds me of my old friend Auberon Herbert, from whose study at Picket Post ran a ladder by a trapdoor in the ceiling to a chair and table on the tiles.

We welcome then the author's sturdy vindication of hard work, and most interestingly in respect of mental activity (p. 187). In this field every physician of like experience will call to mind case after case in which gradual deterioration had set in prematurely in persons who, by retirement from business without any alternative resources in public affairs, hobbies or new engagements, had fallen into mental torpor or dotage. Indeed I would go even farther and deprecate his warnings against "trying the eyes" by reading in the train and the like. When carriage lighting was far less effective than it is now I occupied all my travelling hours in reading and correspondence; and scarcely know how my work could otherwise have been done. I still continue this practice, and use has kept my eyesight active and clear; use which, as Sir Hermann says so well of the brain (p. 187), keeps the peripheral blood and tissues lively. The rust lies in wait in the scabbard. When we read of this person of consideration or that having died "of overwork," having thus sacrificed his very life to his country, the physician smiles; he knows that very rarely is a breakdown due to the work, but rather to some flaw in the system of the body, or, more often still, to physiological errors and sins. But our gratitude is due indeed to the public spirit which devotes a frail or delicate remnant of life to the public weal rather than to coddling itself at home.

On the subtle and insidious penetration of infections which corrupt the values of life perhaps a few more paragraphs might have been written. Every day is adding to our knowledge in this matter; how such agents undermine and disintegrate the fabric of the body, with ultimate effects not for many years perhaps making themselves known; and then often in disguise. Of such, as Sir Hermann says, are certain cardio-arterial degenerations; so that in the list of causes the part played by physical stresses becomes more and more restricted.

Of the deferred effects of alcohol, tobacco, tea, coffee and so forth upon the blood-vessels, effects which I have analysed at length in my *Diseaſes of the Arteries and Angina Pectoris*, if Sir Hermann may in some paragraphs have gone a little farther than the evidence as yet permits, still on the whole his advice is so sound and wise, and in the main so scientific, that it would be unfair to carp at detail. Tobacco, tea, &c., affect different persons so variously that each one of us must work out these drug problems for himself. He is foolish who persists in a habit which arouses any symptoms of disorder. Whether tobacco causes arteriosclerosis or not we do not know; but we do see every day that persistent smokers lose too soon their youthful looks and complexion; a change especially conspicuous in women, who have fallen into the cigarette habit. In men it does not matter so much.

Concerning infections I would add one more point to the precautionary methods of personal hygiene, viz., the "toilet of the nose." It has been a habit of mine morning and evening to rinse the nostrils well through to the throat; ordinarily with water, but in times of epidemic with a disinfectant solution. So far I have never caught an influenza—or other infection—although on more than one occasion I have received a full puff of breath from a case of pneumonic influenza. It is not well enough known that influenza can be stopped in a house if the first patient's chamber is kept in a full draught of air, and if on the entry of any other person the patient always covers the nose and mouth with a pad of disinfectant wool. Thorough brushing of the hair, again, is less attended to than it should be by our busy young women. It is easy to see whether the hair is neglected, and thus left full of dust and bacteria, for it is rough and dull instead of smooth and bright. Bright hair is cleanly hair. The late Dr. Payne pointed out how often the hair is the source of bacterial invasions—such as dandruff, eczema, boils on the neck, acne, &c. This anyone may perceive who brushes his hair in the sunshine.

The precautions to be observed by those who suffer from high arterial pressures, or come of "apoplectic families" are excellent; I would temper them, however, by a warning against such regimen becoming a tyranny and a dread, as not rarely happens. A meticulous counting of blood-pressures, frequently the systolic only which is liable to emotional increase, and the dogging of every meal by the shadow of the doctor, may so eat into a man's morale as to bring about the very ills we would avoid. Certain broad rules should be made and ingrained as a habit, and then followed automatically and with a certain carelessness.

On p. 143 the author remarks on a wholesome kind of emaciation in elderly people. An old friend of mine in Yorkshire, while on his way to call on an acquaintance—a stout man who in later life had become an invalid, fell on the way into conversation with a stonebreaker who had a lifelong knowledge of the district and its inhabitants. When they spoke of their neighbour's failing strength—"Why, Sir," said the man of the road, "you see Mr. X. 'a nivver *dried in* as 'a owt to 'a done." An empirical but acute observation.

Sir Hermann dispenses with sleep more readily than I can do. If I get less than eight hours I have inexorably to make it up during the week or be the slacker for the loss. And I have thought that many men who to my knowledge had stolen hours from sleep to give to work had, in the course of years, borrowed at high usury. Still I admit again that this is more or less an individual problem.

Out of his own rich experience Sir Hermann Weber tells us what happiness, what resources, what service yet remain for the old age of those who have tried to live in harmony with physiological and moral laws; who have dwelt continually in temperance, faith, hope and charity. It is said, I think Sir Hermann says, that all elderly men turn tory. It may be so, though this is not my retrospect. He who has gained a far look back, has he not too often to murmur to himself one long sad burden of Too late! Too late! In home politics, in foreign politics, in diplomacy, in Ireland, in social discontents, in public health, in the churches, in education, in scientific research, in all affairs great and small, if we are not again and again too late to recover something, yet always too late for grace and opportunity. In old age we become wise after events; we desire to create yet one more Ministry, that which shall preside over the meteorology of ideas, of the voices from the human winds and deeps; a Ministry to hoist signals to the helmsmen of states and of nations, that they may no longer, uncharted and ungoverned, drift upon the rocks, or into harbours not our own? If Sir Hermann's mellow wisdom, in the common nurture of body and mind, can keep burning the lamp of imagination and sympathy, and dispel the fog of complacency and prejudice, we shall be his debtors for a fulness of life far more precious than mere length of days.

CLIFFORD ALLBUTT.

Cambridge, January 25, 1919.

PREFACE TO THE FOURTH EDITION.

THIS Fourth Edition contains some additions and alterations, but the arrangement of the whole remains unchanged, as also some passages of the original lecture. Further experience and communications from many of my friends and former patients confirm me in the correctness of the suggestions as to the manner of living contained in it. I claim no originality. Many of those who have written before me and since have given more or less similar advice. I specially mention a book which has appeared since the publication of the last edition of mine (1908), by Alfred von Lindheim, *Saluti Senectutis*, which contains much valuable information, and also Sir R. Douglas Powell's papers on "Advanced Life and its Diseases," and Professor Baeumler's "Altes und Neues." I have myself carried out the rules laid down for others, with perseverance, for the last sixty years, as far as pressure of work allowed me to do. And now in my 91st year I possess good health and a fair amount of strength, and am able, to some degree, to watch the progress in my old profession, in science and art and social matters; and I still enjoy the beauties of Nature in my country walks, and above all things the intercourse with my children and their families and with old friends. It is often said that in old age affection and sympathy cease; but this is not the rule, or at all events a rule with many exceptions.

HERMANN WEBER.

March, 1914.

PREFACE TO THE THIRD EDITION.

In publishing an enlarged edition of "Means for the Prolongation of Life," I have acted on some suggestions made to me by readers of the former editions. Thus I have added a short description of most of the more common articles of food, their digestibility and their *rôle* in the nutrition of the body. I have also divided the contents of the little treatise into a number of sections for easier reference; but I have otherwise left the arrangements and the greater part of the text as in the original lecture.

The Bibliography and the Index will be found more complete.

Since the delivery of this lecture in 1903, several excellent communications on the same subject have appeared, by Sir Lauder Brunton, Professor Metchnikoff, Dr. William Ewart, M. Jean Finot, and others, from which I have derived much useful information.

Some of the advice given may be regarded as commonplace. This is true, but the secret of success in life depends in most instances in acting on commonplace principles, carrying them out thoroughly and adapting them to the circumstances as they occur. This is especially the case in regard to maintaining health, preventing disease, and prolonging life.

During the years which have passed since the First Edition I have been strengthened in my views by intimations from many aged persons, who had carried out my advice for ten and twenty years, and more.

HERMANN WEBER.

June, 1908.

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ON LONGEVITY AND MEANS FOR THE PROLONGATION OF LIFE.

I.—INTRODUCTORY.

THE subject of the prolongation of life is a very large one, especially if considered with regard to the whole population from infancy onward.

The diminution of infant mortality, the combat against tuberculosis, the improvement of the hygienic conditions of towns and houses and the introduction of vaccination and other forms of preventive and curative inoculation have raised, and will continue to raise, the average duration of life. Here is a wide field of usefulness, and one of the most important sections of it is the combat with the various forms of pathogenic microbes in which men like E. Jenner, Pasteur, Lister, Koch and others have rendered immortal services to humanity. And besides, the greater cleanliness in all things, and improvement in the location and internal arrangement of dwellings, the food supply to the labouring classes, and the hygienic, physical and moral education of the entire population ought to commence in the nursery, and ought to be insisted on at all schools, public and private, and to be continued after school days. Drill and discipline should be included, leading to orderliness and to healthiness of the mind, as well as the body. This will not only contribute to the prolongation of life, but improve the whole race, so that our grandchildren and great grandchildren ought not to hear any more of the deterioration of the physique of recruits and other candidates for the navy, the army, the professions and trades. By such means the *resisting power* of the organism to disease ought to be developed from an early period of life. The education, intellectual moral and physical, of each individual ought to lead to the development of the entire organism for the adequate performance of active work during a long period of mature life. An old age of fairly vigorous health should follow, capable of continuing and enjoying some amount of useful work and leading at last to the final period of gradual and painless cessation of the functions of life. We do not expect this evolution to be immediate; but we must steadily work for its attainment from generation to generation. Dr. P. K. Pel [104], in an excellent address on the art of living long and happily, urges with justice that all school boys and girls ought to be taught how to maintain their health and to avoid injurious influences. That very promising subject will, however, scarcely be touched in the present discourse, which will relate principally to the prolongation of life by the arrangement of the manner of living in adult life. This more limited field of work deserves likewise our serious attention, since the death-rate of persons after about 55 or 60 has scarcely decreased during the last thirty or forty years, and that above 70 has even increased, while that of children and adults below 45 is now considerably lower than it was then, as shown by the annual reports of the Registrar-General.

This book, I must premise, is an hygienic and preventive contribution, and does not enter into the pathological anatomy so ably treated by Sir G. Humphry [60], and by Dr. Savill [115] in his interesting papers before the Medical Society in 1897, nor into the clinical symptoms sketched by Sir Clifford Allbutt [2, 3 and 4], by Dr. Savill, Dr. F. Parkes Weber [135], G. W. Balfour, Metchnikoff [80 and 81], and others; nor shall I say much about the mental changes which have quite lately been discussed by Sir William Osler [98] and by the late Sir Samuel Wilks [144]. I shall only suggest a manner of living by which youth and vigour may be prolonged and senile changes may be postponed as long as possible. I intend to exclude treatment by pharmaceutical remedies, and by organo- and serum-therapy; and I must also abstain from entering into the interesting subject of "comparative longevity," for which I may refer to the works of Buffon, Flourens, Sir E. Ray Lankester [70], and others, and restrict myself entirely to the longevity of man. I may mention, however, that already Lord Bacon said that the life of creatures in general endured in proportion to the slowness with which they reached maturity [7]. . .

Much has been written on this subject from remote antiquity up to the present time. When I think, for instance, of Galen's "De Sanitate tuenda," Cicero's "De Senectute," Bacon's "Historia Vitæ et Mortis" [7], Sir William Temple's chapter "of health and longevity," Hufeland's "Makrobiotik" [59], Sir John

Sinclair's "Code of Health" [120], Pel's [104], Pflüger's [106], Ebstein's [37], and many other able works, it may look presumptuous that I address so learned a body on the prolongation of life. I feel that I can hardly say anything new; but the fact that I have occupied myself with this subject for more than half a century, and with a certain measure of success in others as well as myself, and that I may perhaps open up some fresh aspects, embolden me to place before you in a condensed form some of my experiences and views; and I am further moved to this course by an astonishing disregard of the means of prolonging life on the part of the educated public and even of the medical profession.

Since the delivery of my lecture in 1903, several excellent communications have appeared on prolongation of life, amongst which I may mention Sir Lauder Brunton's address [18], Dr. W. Ewart's paper in the *Lancet* [43], Professor Metchnikoff's very instructive and philosophical works [80 and 81], Sir R. Douglas Powell's Lectures [108], as also M. Jean Finot's [44], A. Lorand's, A. von Lindheim's [73], and Professor Baeumler's [9A] contributions.

II.—NATURAL DURATION OF LIFE.

Before we consider how we can attain the natural term of life, we must say a few words about what we may regard as the *natural term*. The great ages attributed to the Hebrew patriarchs need not occupy us here. It is enough to point out that at the time of the Psalmist no such ages were reached, since he puts the limit at 70 and 80 years. This may at the present time still be considered the average term of life, but by careful arrangement of the manner of living this term may be increased in many persons endowed with good constitutions to 90 and 100, and occasionally to more—which we might call supernormal longevity, under present conditions, though in course of time it may become normal longevity. The difficulties of verifying the statements of great ages in past generations are very great, and due criticism has not been exercised. Even the generally accepted great ages of Henry Jenkins, Thomas Parr, and the Countess of Desmond are, according to the investigations of Mr. W. Thom [124], to some degree mythical. We have no proof that these three persons reached the ages which are attributed to them. To come to more recent times, Dr. Tatham, Superintendent of Statistics of the General Register Office, has kindly informed me that according to the census of 1901 there were, in the whole population of England and Wales, living above 90 years, 3,056 males and 6,482 females, in all 9,538; and above 100 years, 47 males and 99 females, in all 146. To the kindness of Mr. S. Jastrzebski I owe the following figures from the census of 1911:—

In *England* and *Wales*, with a population of 36,070,492, lived at:—

Years		Males		Females
90 to 94	...	3,739	...	7,821
95 to 100	...	505	...	1,185
100 and over	...	36	...	92

In *Scotland*, with a population of 4,760,902, lived at:—

Years		Males		Females
90 to 94	...	522	...	1,230
95 to 99	...	80	...	249
100 and over	...	5	...	19

In *Ireland*, with a population of 4,390,219, lived at:—

Years		Males		Females
90 to 95	...	1,643	...	1,989
95 to 100	...	443	...	597
100 and over	...	133	...	181

There is a striking difference in the proportion of people over 90 between England and

Scotland on the one side, and Ireland on the other. It seems to be a fact that the number of old people in Ireland is comparatively greater, but it is also most probable that in Ireland there is a tendency to overstate the number of years in the higher ages.

To Dr. Parkes Weber I am indebted for the following statement about *France* for 1906 ("Résultats Statistiques du Recensement," 1906, Part 2) :—

	Males		Females	Total
Total population ...	19,099,721	...	19,744,932	38,844,653
Living at or about 80	147,018	...	215,161	362,179

In *Germany* 1900 :—

	Males		Females	Total
Population	27,737,247	...	28,629,931	56,367,178
Living 90 to 95 ...	3,306	...	5,571	8,877
95 to 100 ...	329	...	777	1,106
100 and over	8	...	32	40

Sir Lauder Brunton, in his suggestive address on Longevity [18], states, on the authority of the Registrar-General, that during the last half-century a continuous increase of the average duration of life has taken place, from a little over 40 in 1854 to a little under 48 in 1900 ; but that in the decades from 60 to 90 years there is a slight diminution, and that this is also the case at the age of 100 in males, while there is a little increase in females.

"The number of men living to 100 years per 100,000 of the population from 1891 to 1900 is only 7, and of women 24, as compared with 15 men and 36 women in 1838 to 1854." These figures may be, however, Sir Lauder fears, vitiated by the fact that there is a tendency to over-statement between the ages of 55 to 65, "a tendency which grows as the age advances, so that very little reliance can be put on the data of extreme ages." Much more reliance, however, can be placed on the more recent figures. One of the principal causes of the diminished proportion of people living beyond 80 and 90, during the last 50 years, is probably to be found in the great saving of life in childhood by which many weakly children live to 50 and longer, but do not reach the age of 80 or more.

There can be no doubt that circumstances which we comprise by the term "environment" influence the duration of life. Those who live in crowded industrial districts; those who are obliged to share small and ill-ventilated rooms with many others; those who have to spend the whole day in confined factories, easily become victims to infectious disease, or are apt to fall into premature senile decay; while those who live much in the open-air like gardeners and field labourers, provided other circumstances are not unfavourable for them, and country gentlemen with genial occupation, free from much care and jealousy and envy, usually retain a fair share of mental and physical health up to old age. The longevity, however, seems to be somewhat different in different countries. Thus, according to communications by Dr. Ormstein [97], a greater proportion of people reach high ages in Greece than in most other countries, a fact which already Lord Bacon had noticed, especially in the hilly parts of Arcadia; and Metchnikoff makes a similar statement with regard to the Balkans. This is probably due to a combination of the manner of living, climate and other environments. We know that in Norway, Denmark and Sweden the average duration of life is longer than in the South of Europe; and Lord Bacon [7] mentioned already in the 17th and Hufeland [59] in the 18th century that life in colder regions is longer than in warmer; but that extremes of cold are not conducive to longevity. Bacon further stated that long-lived people are more numerous in elevated than in low regions, "if they be not on tops of mountains, but rising grounds" [7].

The temperate and equable climate of the Hebrides is one of the principal causes of the large proportion of long-lived persons in these islands, although the manner of living has, no doubt, a share in it, viz., labour, exercise, diet, i.e., porridge, milk, fish, potatoes, and barley-bread. So at least, it was in former years. Whether the progress of civilization, the introduction of tea and its substitution for porridge has made a change in longevity I am not able to state.* Altogether the duration of life in islands is, as a rule, longer than in the interior of Continents, owing greatly to lesser extremes in temperature and the purifying winds from the sea. The duration of life in different nations and countries is due to a combination of conditions. It is reported that not only the Jews in Palestine, but also the Brahmins, and the Brazilians at the time of the discovery of Brazil, were long-lived people. They had in common, residence in warm regions, and a manner of living which was quite primitive: easy labour, absence of care and passions, and a most simple diet, which consisted mainly of fruit and vegetables, very little

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*** Statistics in regard to long-lived persons in the Hebrides should be obtained from a later census.**

flesh, and water as their drink. Their health and longevity were probably more due to these circumstances than to climate.

It has been stated that some *races* are more long-lived than others. This is to some degree true, but much of the difference seems to depend on the manner of living, climate and other environments. There is, however, one race which is decidedly more long-lived than other races, namely, that of the *Jews*, unless they are living in the greatest poverty and in most unhygienic circumstances, as in Russia. In whatever climate they live, they are, as a rule, distinguished by comparative longevity. It may be that they were originally better constituted, but it appears almost certain that they have derived much benefit from their having obeyed during many centuries the wise hygienic and moral laws of Moses. Through this, we may assume, a kind of heredity for long life has been gradually developed. Dr. Jossé Johnson [65] has discussed this point before the 'Life Assurance Medical Officers' Association. It is stated that the Essenes, a Jewish sect which had adopted the diet of Pythagoras, usually lived to 100 years; but I possess no accurate information.

III. MODE OF LIFE OF LONG-LIVED PERSONS.

In examining the circumstances under which man is likely to reach the natural term of life, and especially the manner of living by which this end can be promoted, we must not allow ourselves to be deterred by the experience that some of the most long-lived persons have led injudicious lives. We may regard such occurrences as exceptions to the rule in persons endowed with specially good constitutions. After having carefully entered into the records of more than 150 cases of very long-lived persons, I have reason to say that by far the majority of them were temperate; were small meat-eaters; lived much in the open air; led an active life; a life full of work; many a life of toil, with great restrictions as to food and comforts; that most of them were early risers; that a great number of them had a joyful disposition, and performed their work cheerfully; and that only a few were self-indulgent or intemperate or idle and lazy persons. We must keep before our eyes the means and circumstances by which the health of man is founded and maintained, and those by which it is usually deteriorated, since the former are likely to promote, while the latter are almost sure to prevent, longevity in the large majority of cases. Almost all those who have occupied themselves with the study of means tending to longevity have come to the conclusion that *work* and *moderation* are the most powerful promoters, and that *idleness*, dissipation and gluttony are the most frequent sources of disease, of premature senility, and early death.

The first aim of those wishing for long life must be the maintenance of *health*, life's greatest blessing. Without health all the goods of the world are deprived of their value; with it we enjoy work, social life, the beauties of nature; to obtain and hold it no sacrifice in restricting sensual enjoyment is too great. It is health and not riches which brings happiness; in fact, unless prudence be a constant attendant on opulence, "'tis better living on a slender fortune" (Dr. Mead [76A]).

We must, in laying down certain rules towards the promotion of a long life, and of a vigorous and happy old age, not be checked by the remarks which we constantly hear, especially from the self-indulgent and lazy, that such rules are irksome, that a short and enjoyable life is preferable to a long and tedious one with many restrictions; that it is not worth while to live to an old age full of suffering and of physical and mental weakness. No, we do not wish to prolong life merely for living long. If we divide life into three periods, viz: (1) the period of growth or ascent; (2) the period of the acme or greatest power and usefulness; and (3) that of gradual descent and declining ability, we wish by prolonging the duration of the whole life, to prolong especially the acme, and to maintain for the third a fair amount of mental and physical efficiency, and this with a measure of enjoyment and usefulness, without bodily suffering. "*Non est vivere, sed valere vita.*" I have been in intimate relation with many distinguished persons, male and female, who reached old age. It is true that some of them were suffering, and that the senses and mental faculties of most of them were somewhat impaired, when compared with the period of greatest vigour, but many of them had retained their interest in the progress of science, in the evolution of social problems, and in the education and prosperity of their own families and descendants; they were often able to give wise counsel, and to show the way to progress and success; they were eager to read and to learn, and to help. They all ascribed their happy old age mainly to work, and said that work also helped them to contentedness and to overcoming of illness, pain and worry.

> "The labour we delight in physics pain."
> Macbeth II-3.

It is such old age which we wish to obtain by our rules for prolonging life. Many highly gifted energetic old men and women, Baeumler says in his interesting contribution [9A], take no notice at all of what they have lost, but are happy with what remains to them, and he mentions as such an instance, Oliver Wendell Holmes, the anatomist and author, who fell asleep at 85. My friend Dr. Frank has reminded me of the conversation on this subject between Socrates and Cephalus in Plato's "Republic," where Cephalus maintains that those who possess a well-regulated mind find old age no intolerable burden, but, on the contrary, are more happy in the mental repose and freedom from passions. Cornaro [29] in his treatises written after the age of 83, describes his life as full of work and happiness. Many of my own friends who had been pessimistic in their youth and early manhood have become optimistic in advanced life.

I am convinced, from a large experience, that the manner of living required for the prolongation of life is either not at all irksome, or only at the beginning, that it becomes easy by habit and leads to health of mind and body, to increased usefulness, to freedom from suffering, and to happiness much greater and more enduring than that to be obtained by yielding to the desire of indulgence in sensual or frivolous enjoyment. When I hear that a life of work and moderation is tedious, I am always reminded of the words of Ferdinand in "The Tempest".

> "There be some sports are painful; but their labou
> Delight in them sets off: some kinds of baseness
> Are nobly undergone; and most poor matters
> Point to rich ends."
>
> Act III, Sc. I.

At first the regular walking and working and early rising may appear "poor matters," and not less so the moderation, when one has to curb a good appetite before a richly covered table; but then come the "rich ends": health and happiness, and a long and happy life, full of activity, to terminate frequently by falling asleep without suffering.

I wish I could convince everybody of the beneficial influence of these rules of health and longevity, since such conviction would cause their adoption with readiness and not with the sense of drudgery.

Self-indulgence leads mostly to failure and unhappiness, *self-control* to success and happiness.

IV.—HEREDITY.

Amongst the circumstances connected with longevity the most prominent is *heredity*, which means an inherited good constitution. I have endeavoured to ascertain what are the principal factors of this inherited longevity, whether it is to be ascribed more to one system of the body than to another. Almost all the aged persons whom I have examined with regard to this question seemed to have had an all-round good constitution ; all of them were, however, specially endowed, as far as I could learn, with a vigorous heart and good blood-vessels, and I am inclined to ascribe to the circulatory system the greatest share, though I know that the circulatory cannot be separated from the respiratory and the nervous systems. It is, as a rule, not the vigour of the muscular system which leads to longevity ; athletes and men with great muscular strength form a small percentage of the long-lived people ; nor does great intellectual power seem to be a prominent and general feature ; nor a strong digestive system, which, although useful when well managed, often gives rise to over-feeding, while a weak digestion compels moderation, and thus leads frequently to a longer life and happier old age than is obtained by those endowed with a strong digestion.

The degree of health and strength at birth and in childhood does not always indicate the measure of health in later years and the duration of life. It occurs not rarely that of the children of the same parents, those strongest in childhood die earlier than the weaker ones, and that the weakest in infancy live longest. In my own experience two men who lived to above 90 were during their childhood so weak that it was said that they could not live to manhood, and that their lives were refused by insurance offices, while their brothers and sisters, who were regarded as strong died much earlier. It is stated that both Hippocrates and Galen, who lived to very advanced ages, were weak in their childhood. Amongst many well-known long-lived men, Voltaire and Goethe were considered weak in childhood.[1]

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[1] Although a number of long-lived families are known, I venture to refer to the longevity of two families: (1) of Sarah Ann Alexander of Reigate, published in the *Friend* of

The chances of a person belonging to a *long-lived family* are, *ceteris paribus*, much better than those of a person belonging to ordinary families, but it is a dangerous fallacy to rely too much on such a privilege. In a family well-known to me, for instance, out of 11 children, whose parents (both) died above 90, 5 men and 4 women, leading satisfactory lives, lived to 88 and more, while 2 addicted to alcohol died between 60 and 70. In another family of 8 children, whose father had lived to 87, while the mother had reached the age of 96, only half of them, viz., 3 daughters and 1 son, lived beyond 86, while 3 sons and 1 daughter died under 70. The first 4 had lived judiciously, while of the 4 dying prematurely, two sons had over-indulged themselves with eating as well as drinking, one with

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February 19, 1917, on the occasion of her 100th birthday (January 15, 1917). Her father died rather early in consequence of an accident, but belonged to a long-lived family. The longevity seems to be due to the father's as well as to the mother's family. Miss Alexander's mother, Ann Barber, died in 1861, aged 86. Of three daughters of this lady, the two elder died within three days of one another in July 1907, at 103 and 93 years of age, the third, Sarah Ann Alexander, was in good health on her 100th birthday. The record of eight members of this remarkable Quaker family shows an average age at the present time, of 89 years 6 months. The names appear in order of age.

drinking only, and the fourth, a daughter, having had a large family, with short intervals between the successive childbirths, became mentally depressed by frequent sources of grief and anxiety and died before the age of 70. The result of my own experience is that long life is not always the result of heredity alone, but of *heredity combined with environments*, comprising in the latter term, healthy conditions of life and judicious education for mind and body. In some cases the first has the greater share, in others the second. Professor Baeumler [9A] ascribes to heredity the greater influence, and especially to the inborn constitution of the *nervous system* which controls the functions of the whole organism and each organ. He does not, however, deny that

—	Place and date of death	Age	
		Yrs.	Months
George William	Reigate, November, 1890	88	7
Mary Barber	„ February, 1907	103	5
William Dollin	Brighton, April, 1887	81	11
Henry	Circencester, Sept., 1899	91	3
Samuel	Leominster, May, 1884	74	9
Frederick	Clifton, July, 1893	82	3
Elizabeth	Reigate, February, 1907	93	10
Sarah Ann	Surviving	100	0

This gives an average amongst the eight brothers and sisters of 89½ years.

favourable surroundings may make amends for presumably innate inferiority.

The tendency to *early death* is certainly likewise hereditary in some families to such a degree that careful assurance offices refuse members of such families; but by judicious management, if commenced early enough, the life can be considerably prolonged in spite of the inherited tendency to early death, which seems to be mostly associated with a weak circulatory system. We must endeavour to profit by the favourable influences of heredity, but counteract the unfavourable: we need not die at the same early ages as our forefathers did; we must not adhere to fatalism, or the idea that "what is decreed for us, cannot be altered," which is one of the worst doctrines; but we must trust in our own work, and in the truth of the proverb

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I may add, that on inquiry I have learnt that the whole family were active, moderate and temperate, some of them entire abstainers.

(2) This record of the Alexander family is equalled, even slightly surpassed, by that of the Kempe family, published in the *Times* of February 4, 1918, by John A. Kempe: Mrs. Arthur John Mozley, of Cheltenham, completed her 103rd year on January 22, 1918. She is the last survivor of the eleven children of Alfred John Kempe, antiquary. One died in infancy. The record of the remaining ten is as follows:—

that "God helps those who help themselves." Most persons descended from short-lived ancestors have it in their power to prolong their lives by a judicious manner of living. I have a very large experience before me showing the possibility of counteracting the inherited tendency to early death. Everyone ought to recognize the special dangers to which such a tendency exposes

	Born	Died	Age	
			Yrs.	Days
Rev. John Edward Kempe	Mar. 9, 1810	Mar. 10, 1907	97	1
Miss Mary Anne Kempe	Dec. 22, 1811	Nov. 13, 1899	87	326
Rev. Alfred Arrow Kempe	April 13, 1813	Dec. 15, 1909	96	246
Anna Eliza Mozley	Jan. 22, 1815	Still living	103	
Jemima Frances Martin	Dec. 26, 1816	May 6, 1911	94	131
Caroline Wilhelmina Davies	Mar. 14, 1820	July 13, 1903	83	121
Adeline Octavia Benson	Nov. 19, 1821	Nov. 12, 1916	94	358
Charles Nicholas Kempe	Aug. 23, 1827	Dec. 9, 1904	77	108
Eleanor Brandreth Parish	Dec. 3, 1829	Mar. 17, 1916	86	104
Reginald Carlisle Kempe	Nov. 23, 1831	Dec. 2, 1916	85	9
Total			905 yrs., 309 dys	

The average age attained by the ten children thus exceed 90½ years, five of them reaching an average of above 97 years and the other five nearly 84.

him and ought to counteract them from as early a period of life as possible.

It seems to me a matter of importance to keep the idea of our power of influencing heredity constantly before our minds. In the same way as different hereditary varieties can be produced in animals and plants, hereditary tendencies to long life can, I think, be engendered in man by protecting him from, or making him avoid, injurious influences—dietetic, climatic, hygienic, social, moral, &c., and by substituting favourable for injurious influences. If this view were to be taken up generally, and acted upon, we might have, in the course of centuries, many long-lived and few short-lived families. Much, no doubt, can be done by physical and mental education, great moderation and suitable occupation; but the most powerful influence would be exerted by encouraging well-selected marriages, and by preventing ill-suited ones. On this matter, however, we have, as yet, little power. Love is not generally influenced by considerations of health and longevity. The *Eugenics* Society, will, we hope, in course of generations succeed in educating the public and in rendering it more amenable to sacrifices necessary for the improvement of our race. The time is imminent, we hope, when the state will enforce judicious laws in this direction, prevent marriages amongst the unfit, and encourage early marriages amongst the well-fit.

I shall return to the subject of counteracting hereditary tendencies to early death in a later chapter on "Prevention of Disease."

In order to prolong the life in members of short-lived families it is most important to become acquainted with the *causes of death of the parents and blood relatives*, since by counteracting the tendency to these diseases and causes of death from an early period, we mostly succeed in prolonging life. This is generally conceded with regard to tuberculosis; but numerous deaths between 50 and 70, which are caused by the weakness of the fibres of the heart and by morbid changes in the coats of the arteries and capillaries, can be avoided, or, at all events, greatly postponed, by regular exercise, including walking, climbing, hunting and breathing exercises; combined with great moderation in food and alcohol, and by promoting regular action of the bowels. The tendency to atheromatous and allied changes to arterio-sclerosis, to apoplexy and paralysis, should be opposed by the same means; the tendency to diabetes and to gall-stones, by similar hygienic and dietetic measures; the tendency to senile bronchitis and pneumonia, which form frequent causes of death in advanced life, by much air out of doors and indoors, especially in the bedrooms, by respiratory and other exercises tending to strengthen the heart and the lungs; the disposition to insanity, to epilepsy and to certain forms of dipsomania, by total abstinence from youth onwards, by regular occupation of body and mind. Most other hereditary causes of early death can generally be effectively opposed by judicious arrangement of the manner of living.

By appreciating the individual constitution, the tendencies to disease indicated by the family history, by the habit of the body, occupation, &c., we are often able to prevent disease; we must endeavour to recognize all the weak points of the entire organism, and direct our attention to *strengthening these weak points. Above all things we must bear in mind* that *work*, *moderation in food* and *good air* in and out of doors are the most powerful factors in improving and maintaining health, and prolonging life. Two or three hours or more every day ought to be spent in the open air and almost all, even most delicate persons, can gradually accustom themselves to it. We have heard from many persons the objection that they cannot bear much open air, that it causes with them catarrh, rheumatism, neuralgia and many other complaints, but most of these objectors became by degrees convinced that they could accustom themselves to it, and that it was not the abundance of air which had caused these troubles, but the injudicious and imperfect way in which they had exposed themselves to it; for instance, by opening small chinks in the windows instead of the whole windows, or by imperfectly closing doors, or by sitting between the door or window and the fireplace, or by driving in closed carriages with the window of one side partly open, instead of driving in an entirely open carriage or in an open bath-chair. Admitting the air through a small opening causes *draught*, which often produces in sensitive ill persons, a local chill of the eye, the ear, the neck or other parts, while by allowing the air to enter the room through fully open windows or doors, the body becomes soon accustomed to it, is strengthened, and gains in resisting power. It is scarcely necessary to add that I do not wish to recommend delicate persons accustomed to close warm rooms, to expose themselves all at once to a combination of cold air with high wind, but gradually accustom themselves to such healthful conditions, and thus to raise their *resisting power*, which not only helps them in the fight against the morbid hereditary tendencies, but also in their combat with the bacteria of all infectious diseases.

To return to unfavourable heredity, I could give a great many instances of persons who escaped the diseases of their parents and premature death by well-adapted management. I will, however, only mention five, beginning with my own.

CASE 1.—My mother died before she was 60 from weakness of the heart, inherited from her father and grandfather, which led to frequent attacks of bronchitis and general dropsy; my father died likewise in his 60th year from cerebral apoplexy; he had not been an abstainer himself, and his forefathers, during four or five generations, had taken largely the strongest kinds of hock and port, and died from affections of gouty nature, including one of paralysis and one of apoplexy, mostly under 71 years of age. By moderation in eating and drinking and abundant exercise of body and mind, including walking, climbing and breathing exercises, I have escaped death from these causes, have greatly prolonged my life, and am now in good health in my 95th year.

CASE 2.—Nearly fifty (now sixty) years ago a gentleman consulted me, at the age of 41, who suffered from frequent attacks of bronchial catarrh, from weakness of the heart, was rather stout, had a sedentary occupation, avoided active exercise, took much meat, and was inclined to constipation and bleeding piles. His father had died from "chronic bronchitis with dropsy" at the age of 61; his paternal grandfather from "bronchitis and congestion of the lungs" at 64; while his mother, belonging to a rather short-lived family, had died from "pneumonia," aged 59. By means of great moderation in eating, especially of flesh food, and drinking, with attention to his bowels, by living much in the open air and in well-ventilated rooms, by regular walking and breathing exercises, the tendency to bronchial catarrh, to constipation and piles, was checked, and he lived to the age of 75, when he succumbed to a severe attack of influenza. Three brothers and one sister, who had not followed out similar regimes, but had indulged themselves, more or less, like their ancestors, died before they were 60, from chronic diseases of the heart or of the respiratory organs.

CASE 3.—In 1862 I saw a gentleman, aged 44, whose father and grandfather had died under 64 years of age from apoplexy; while his mother, who had belonged to a fairly long-lived family, had lived to 69. The patient, who was in the habit of eating and drinking largely and was of florid complexion, muscular, slightly above the average weight for his height, had had two severe attacks of gout. He was induced to diminish the quantity of meat to a very small amount, and to take it only on two days in the week, to substitute for the decrease of flesh food a larger allowance of cheese, of green vegetables and fruit, to give up stimulants almost entirely, and to walk several hours a day, and practise breathing exercises. The result was that the attacks of gout ceased after some years, that his general health became perfect, and that he was able to enjoy the pleasures of intellectual and social work up to 78 years of age, when he began to show signs of weakness of the heart after an accident which prevented his continuing to take active exercise. The final cause of death was pneumonia. Two brothers and a sister of this gentleman, who had indulged their appetites and taken little active exercise, died between 60 and 66, from apoplexy, and others at earlier ages from bronchial attacks and failure of the heart.

We may fairly assume that life in Case 3 was considerably prolonged through his combating the family tendency to apoplexy and failure of the respiratory system and heart, by means of great moderation and much exercise; and the same may be said of the subject of Case 2 with regard to the inherited tendency to weakness of the heart and respiratory system.

Still more striking is the effect of the manner of living in counteracting the hereditary tendency to early death in Cases 4 and 5.

Case 4.—A. C., a member of a family of five sons and five daughters, consulted me when aged 35, complaining of weakness, shortness of breath, especially after lunch, and frequent sleepiness, particularly after meals. His family history was very grave. His father had died at 49 from bronchitis; his paternal grandfather at 48 from "dropsy"; his paternal grandmother at 55 from pneumonia; his mother had died suddenly at 52 from "failure of the heart"; his maternal grandfather at 51 from apoplexy; his maternal grandmother at 56 from "dropsy." His life had been refused by several insurance offices. The patient was a solicitor who took little exercise, lived freely in eating and drinking, and slept mostly over eight hours. The heart was feeble, the face was red from congested capillaries. I advised him to take meat or fleshy food only once a day and in small quantity; to limit the stimulants to a quarter of a bottle of light claret during the twenty-four hours, and the sleep to six hours. In addition, he was ordered to take breathing exercises every morning during a quarter of an hour, a hot bath followed by a cold shower, and to walk at least two hours a day. This manner of living led, within two months, to great improvement, after which the daily walking exercise was supplemented by a whole day's walking or shooting at least once a week. On this regime A. C. lived in good health up to the age of 74, when he died from influenza.

All the four brothers of A. C., who lived on the plan that they must "*sustain*" themselves by eating and drinking generously, and avoid exertion in order to prevent "wearing out," died between 49 and 56 (one from failure of the heart, one from apoplexy, one after an operation for stone, one from cause unknown to me). Of the five sisters, three died from various diseases under 56, one from accident at 45; the fifth, who died at 75, is the subject of Case 5.

CASE 5.—A married lady, aged 36, a sister of the subject of Case 4, consulted me on account of shortness of breath, œdema of the legs, and varicose veins. She had had four children, the youngest being 3 years old. Her heart was dilated; she was rather stout; the urine was normal. She was in the habit of eating rather largely and taking much water and soups at lunch and dinner. She took scarcely any exercise. She was ordered to take a small help of meat only once a day; to take little salt, no soup, nor other fluid at the two principal meals, but a small tumblerful of water night and morning; to begin with very gentle breathing exercises and two short walks every day in all weathers, and gradually to increase the amount of breathing and walking exercises. Within four weeks the œdema of the legs had disappeared, and after another month she was able to walk two hours every day. On this plan her health further improved and remained satisfactory up to the age of 70, when I lost sight of her; but I heard later that she had died at 75, some months after an accident.

V.—CAUSE OF DEATH FROM OLD AGE.

Death from *old age* is caused by a kind of *atrophy of the tissues and organs*, especially the cellular elements, connected with changes in the small blood-vessels and lymphatics. For the more accurate description of these senile changes I refer to Professor Humphry's classical work on "Old Age" [60]; to Professor Metchnikoff's English edition on "Prolongation of Life" [81] and "Etudes sur la Vieillesse" [82], and to the articles on "Old Age" in the second edition of Allbutt and Rolleston's "System of Medicine," by Dr. Parkes Weber [135]. We must counteract this tendency to *senile atrophy* by supplying the tissues and organs with healthy blood; and to do so we must endeavour to produce a healthy state of the blood and to maintain the blood-vessels and lymphatics in a sound and vigorous condition. Life, we may say, depends to a great extent on the state of the organs of circulation, including the heart, the small arteries, the capillaries and lymphatics, which latter have in old age a great tendency to obliteration; and our aim must be to prevent or postpone as much as possible their degeneration or obliteration. The way to effect this is to keep all the organs in *action*. This sounds very *simple*, but it is a very complicated matter. It is not by directing our attention to one system such as the muscular system, or the circulation and respiration, or the digestive organs and food, or the skin, or the brain and the functions of the mind, but we must consider them all, and must endeavour to make them work together in perfect harmony.

VI.—ACTION OF EXERCISE ON THE MUSCULAR SYSTEM, ON THE METABOLISM, AND ON THE HEART AND BLOOD-VESSELS.

Almost everyone can observe on himself that the arms become weak and thin and their muscles flaccid, if they are not used, while they increase in size and firmness if they are thoroughly worked. Exercise of a muscle increases its nutrition; exercise of the different parts of the body, limbs and trunk, strengthens the whole muscular system, and this is of the greatest value to the entire organism, since the function of the muscular system is not only the motion of the body and its different parts, but also the promotion of metabolism and the generation of heat.

The physiological processes connected with the all-important question have been studied by Ludwig and his pupils, including in this country especially, Sir Lauder Brunton and Dr. George Oliver. During the action of the muscle its arterioles become widened, more blood flows into the capillaries and the flow of lymph is increased; thus more nourishment and more oxygen are carried to the tissues, and at the same time the waste products are removed. This has often been demonstrated on the muscle; it is, however, not only the muscular fibre which gains, but the nutritive vessels and absorbents themselves gain equally much by being kept in action. The increased afflux of blood, which is caused by the action of the muscle, forces the small vessels to work, and to conduct more blood to the tissues, and thus their coats are maintained in a sound condition. At the same time the lymphatics are kept in action by the removal of the increased amount of fluid from the lymph spaces, containing the used-up material and the substances not wanted by the muscular fibres. Similar is the case with the brain and nerve centres; the acts of thinking and of initiating movements in the voluntary muscles lead to afflux of blood to the respective nerve centres; to increased nutrition of the ganglion cells and nerve fibres, and at the same time of the minute vessels, afferent as well as efferent. The increased afflux of blood to the brain by the act of thinking has been shown by the ingenious experiment of Mosso [86], one of Ludwig's pupils, who, as you know, has constructed a finely balanced table on which he placed a man in the horizontal position, and demonstrated that during the act of thinking the head becomes heavier, so that the head portion of the table goes down. Mosso also observed on persons with a hole in the skull, that the volume of the brain increases during the act of thinking and diminishes during quiet sleep.

The healthy condition of the *heart and blood-vessels*, which is necessary for maintaining the nutrition of the organs and tissues, is effected by keeping them in constant action. A certain amount of action is inherent to them without any effort of the will. This amount of inherent action varies considerably in different individuals. In some constitutions the system of circulation, and, through it, the health of the organs, remains satisfactory during a long life without any special stimulus; but in the majority it is apt to decay at a more or less early period of life. These tendencies to early decay are, as already mentioned, in many families hereditary, and must be counteracted by judicious means.

If we review the different means in our power to prevent early decay and to keep the circulatory system in a healthy condition, we find that the most efficacious of them are the different forms of *exercise*. Muscular exercise is one of the most powerful means of preventing *arterio-sclerosis* which Sir Lauder Brunton in his address on Longevity [18] calls "the great enemy to longevity."

The mode of action of *muscular exercise*, Dr. George Oliver explains in his address delivered before the British Balneological and Climatological Society in May, 1903. He made a large number of experiments on the effects of respiratory and muscular exercises on the blood-pressure and on the tissue lymph circulation, and he found "that all these exercises (respiratory and muscular) produce the same effect, namely: (*a*) A rise of blood-pressure, and an increase of tissue fluid during the continuance of the exercises; and (*b*) a rapid decrease and immediate fall of the pressure, and a diminution of the tissue fluid on the cessation of them"; and he further found "that the rise and subsequent fall in pressure and in tissue lymph are greater when these two forms of exercise—muscular and respiratory—are combined, than when one or the other is practised alone." He concludes "that exercise (whether respiratory or solely muscular, or both combined) stimulates the fluid exchange between the blood and tissue space." Sir Lauder Brunton, in his lecture on Atheroma [15] describes how each contraction of the muscle drives the fluid onward, and how with each relaxation its tissue juice and products of waste are sucked into the lymph spaces and lymphatics. Thus amongst the effects of all forms of exercise, one of the most imporant is the promotion of the *removal of the waste products* of the tissues. Many chronic affections, such as gout, are caused by the imperfect removal of the waste materials.

Walking Exercise—The most natural, the most easily obtainable, the most economic form of exercise is *walking*. Already Hippocrates said, that of all exercises walking is the most natural to men in good health. By walking almost all the muscles of the body are exercised, and the action of the heart and the breathing are accelerated; all the organs of circulation, including the coronary arteries, are put in action; more blood is passed into the blood-vessels of the body, which are obliged to contract more vigorously and carry it with greater energy to the different organs and tissues, nourish the latter and become themselves nourished by the work.

At the same time the number and depth of inspirations are increased, the blood is improved, more oxygen is taken up and more carbonic acid is given out, and the metabolism of the whole body is promoted. Lavoisier and Seguin were, as far as I know, the first to show that by muscular exercise more oxygen is absorbed and more carbonic acid is eliminated. Walking also influences the action of the heart in another way; by the contractions of the muscles of the feet and legs all afferent vessels of the lower extremities carry to them more blood from the heart, and the efferent vessels, the veins and lymphatics, carry more blood and lymph back to the heart and force it to contract more energetically. Walking improves the condition of the veins of the lower extremities: (1) by the squeezing out of the blood through contraction of the muscles; (2) by the increased pumping action of the heart. The circulation of the blood and lymph in the abdominal cavity is likewise powerfully promoted by the act of walking; as well through the increased pumping action of the heart, as also through the increased contractions of the diaphragm and abdominal walls. All the organs of the abdominal cavity, including the sympathetic nervous system, share the improved state of the circulation. In addition to these effects of walking we must take into consideration the fluid exchange between the blood and the tissues, explained by Dr. Oliver's observations previously mentioned. Walking promotes the healthy condition of the blood and all its constituents, and also the nutrition of the glandular organs, including the ductless glands and their functions, which, though not yet entirely known, exercise a most powerful influence on the health of the whole body. Another effect of walking, and of all muscular exercises, is the improvement of the metabolism and nutrition of the muscles, and this in itself is one of the most important means of counteracting the natural tendency to decay; for the atrophy of the muscles is in most persons one of the first manifestations of senility, and is one of the main causes of the loss of weight, of the deterioration of the metabolism and the power of heat-production in aged people. Already Friar Roger Baron stated that after the age of 40 or at most 50 years, the body heat begins to diminish, and ascribed to this loss the increasing defects of old age; and even long before him, Galen regarded coldness and dryness as attributes of old age. The beneficial influence of walking extends to all the organs of the body, the internal as well as the skin, the nutrition and functions of which are much improved, a matter to which I shall return later on (Section XIV). Many persons suffering from a cold dry skin find in walking exercise the greatest relief. Yet another effect of walking and other muscular exercise is a change in the distribution of blood in the body: the action of the muscles of the limbs produces increased afflux of blood to them, by which blood is removed from the internal organs, and stagnation of blood in the latter is counteracted. This circumstance explains also something which persons of limited strength have noticed in themselves, viz., that hard walking or other hard muscular exercise taken soon after meals disturbs their digestion. The principal cause of this is that the action of the voluntary muscles after meals draws away part of the blood which the stomach requires for its work.

Many persons, including men of literary occupations, even medical men, and many women, think that walking exercise is quite unnecessary; but the great majority of those who hold that view and act on it suffer in later years from the neglect of this and other active exercises. The organization of man, the large lower extremities with which he is provided, show that they are destined for active use.

The *amount of walking* necessary and useful to maintain health varies widely in different person and even, in the same persons under different circumstances; we may say from half an hour to two or three hours a day and even more. We must consider as well what *can* be done, as what is *desirable*. It depends not only on the constitution of a person, but also on the varying state of health, on habit, on age, on the meteorological surroundings, such as heat or cold, humidity or dryness, movement or stagnation of air, on the clothing and other circumstances. What is only just sufficient for one is great excess to another, or to the same person under different circumstances. Anæmic persons bear only a limited amount of exercise, and over-exertion of any kind has an injurious effect on them. In persons unaccustomed to exercise the muscles of the heart are mostly weak, and a long walk or an active climb of some hours can produce an *overstrain* of the heart of grave import, even permanant dilatation, but such a person after some training can make a similar exertion without any feeling of fatigue.

of dyspnœa. The amount which is useful and possible must be judged by the condition of the individual at the time being and the effect produced. *It ought not to be extended to the feeling of distress:* a rule which holds good for all forms of exercise. We cannot insist too much on this point. We have repeatedly seen irretrievable harm and even death caused by hard walking, especially climbing, in the Alps and in the mountains of England and Wales; and also by running and rowing matches, in persons who were in an untrained condition, while they had been able to undergo greater exertion six or twelve months before, when they had become accustomed to them by gradually increasing work. Thus I have repeatedly seen injurious effects in old cricket and football players, who after long intervals of rest, suddenly threw themselves into great exertion.

When warning against real over-exertion, I must point out a feeling of false fatigue which not rarely occurs at the beginning of a walk, but disappears after a quarter or half an hour's active walking. We must distinguish this from real fatigue, and not yield to the desire to remain quiet.

As to the best *time of the day for walking*, the majority of strong persons can walk at all times and may therefore select the hours most convenient to them; but many *weak* persons feel that much walking just before or after the principal meals interferes with their digestion; they ought to walk at intermediate times; they also ought to avoid much active exercise before breakfast, while for strong people an early morning walk after taking a tumblerful of water, or a cup of weak tea or milk, is most useful and enjoyable. The majority of people take their walks with advantage between breakfast and lunch and between lunch and dinner, and the later part of the evening. We must allude here to a common error, viz., that walking *by night* is to be avoided. The idea that night air is injurious to healthy persons is quite incorrect. Owing to this error many persons walk very little during winter, especially those engaged in offices. The insufficient amount of walking exercise and of stay in the open air is one of the principal causes why, during winter and early spring, the resisting power of so many people is diminished, and why in consequence they fall a prey to frequent colds, to bronchitis, pneumonia, rheumatic fever, and other illnesses in spring. Those who spend several hours by night or day in the open air are infinitely less liable to them than those who remain in confined rooms. Although the night air is colder, the cold can easily be resisted by warm clothing, and *moderately cold weather* exercises on healthy persons a tonic influence.

There is great difference in the manner of walking. Some persons walk with a firm step, well-contracted muscles and perfectly erect; others walk with a slack step, loosened or half bent knees and a kind of stoop; there is a great tendency to this latter in old age, which ought to be fought against by strength of will. Walking and also standing with well contracted muscles has a much more beneficial influence on the nutrition of the muscles, on metabolism, and general health, and ought therefore to be made a *habit.*

The *pace* of the walk likewise deserves consideration, and ought to be different in different individual conditions and under different circumstances. We hear sometimes that persons are told to walk one or two, or three, or four miles an hour, but no general rules can be laid down excepting perhaps this, that the pace ought not to be so rapid as to cause palpitation of the heart or breathlessness, and, on the other side, ought to be quick enough to effect a gentle glow of the whole body. Here again *habit* is of great importance, and a habit suitable to the constitution ought to be acquired gradually, and not to be changed suddenly. When a person, accustomed to a rate of one or two miles an hour, is induced by vigorous companions to walk four miles an hour or more, great harm is occasionally done. Stout persons, many of whom have weak hearts, ought, as a rule, not to run or to walk fast ; a rule which holds also good for aged people ; but such rules are subject to many exceptions. It is sometimes laid down that a person above 65 ought not to exceed two miles an hour, but by careful training a habit may be produced which allows a quicker rate even at the age of 75 to 80 and more, *if all the organs are sound.* Whatever can be accomplished by the aged, as well with regard to the pace as to the amount of exercise, ought to be maintained, but *exhaustion* ought to be avoided. *The condition of the organs, especially the blood-vessels, is of greater importance than the number of years.*

It is beneficial to many people with a sound heart occasionally to *run*, especially down hill, since by the act of running some sets of muscles are put into action which by mere walking are only slightly used; all the abdominal organs are shaken by it, and the circulation in the whole body is much accelerated. Old persons are mostly forbidden to run; but this again, is a rule which admits of numerous exceptions. We ought certainly not to advise aged people who have had no run for many months or years to begin with a rapid run of five minutes or a run for a train; but by commencing with a gentle run of one or two minutes they can, if their organs are sound, gradually increase the time and pace with great advantage.

It often occurs that persons advancing in years, after having been prevented by illness or other causes from taking their regular walks, feel fatigued when first resuming them, and infer from this that they are too old or too weak to take proper walks, and in consequence discontinue them, lose power and inclination and finally become prematurely old. Whenever I succeeded in persuading such persons to commence with short walks and gradually increase them, they regained the habit of exercise, and thus postponed the senile decay. The same holds good with the giving up of the exercise of the mind, or of professional or other work

To many persons the retiring from business or from work on obtaining a fortune or a pension is the cause of premature decay. We shall return to this subject later on.

A remarkable instance of this class has occurred to me in a beggar who, having by an accident in childhood lost both legs, had acquired a little fortune by begging while wheeling himself about on a public promenade. He retired at the age of 50 from this occupation and remained in his room or on his doorstep on most days from morning till night, and slept ten to twelve hours, but continued to take the amount of food he used to take during active exercise. He soon began to become stout, to lose strength and vivacity and died within four years from apoplexy.

Walking exercises also a most beneficial influence on the *mind* and the *mental faculties*. *Leslie Stephen*, himself a great walker, says that most men of letters have been enthusiastic walkers. *Swift*, he thinks, was perhaps the first man to show a full appreciation of the moral and physical advantages of walking, and Leslie Stephen attributes to *Wesley's* love for fresh air exercise some of the spirit in his sermons. *Thomas Hobbes*, the philosopher

(1588 to 1679) regarded walking and other physical exercises as the best means for health and longevity. *Fielding* shows by one of his heroes, Parson Adams, that he was a admirer of walking exercise. *Wordsworth* was a great walker, and his walks in beautiful scenery probably have inspired many of his poems. So were *Sir Walter Scott*, *Coleridge*, *Carlyle*, *Gladstone*, and many others who owed to their love of walking much of their vigorous naturalism.

Walking and other muscular exercises are as beneficial and necessary to women as to men. The very limited amount of exercise formerly taken by women was a prominent cause of many of their ailments. Better views are fortunately now held, and ought to be furthered.

People in advanced age are unable to take as much exercise as those in earlier life ; but they ought to walk as much as they can, without actual fatigue, once, twice, or three times a day. If they are otherwise fairly healthy, they must not be induced by a feeling of tiredness at the beginning of the walk to cut it short. By persevering in the walk the tiredness mostly disappears, and they maintain the power of their muscles, while by yielding to the false tiredness their muscles become atrophied. The loss of muscular power impairs the metabolism, the heat production, and the resisting power of the body, and thus leads to premature senility. There are, however, exceptions to this rule, and some persons attain long life in spite of very limited muscular exercise. Most of those exceptional persons whom I have known had a placid temperament, had an active mind, and were very moderate in all matters.

Although, as previously mentioned, we exercise by walking not only the muscles and blood-vessels of the legs, but influence by it almost all other parts, and all the tissues of the body and their component cells, including the brain cells, we ought also to practise movements of the *trunk*, the *arms*, and the *hands*. Most persons can combine this to some degree with the regular breathing exercises, and those who cannot ought to devote a short time once or twice every day to exercises of the trunk, the arms, and the hands. Carpentering, turning, chopping of wood, are most useful, and not less so some active games like golf, cricket, hockey and tennis.

Before leaving the subject of exercise I ought to mention that it is important to exercise the *left* hand and arm as well as the right, since by neglecting the use of the left hand, a corresponding part of the right hemisphere of the brain is imperfectly nourished and often becomes diseased, leading to hemiplegia and allied disorders. A certain amount of ambidexterity ought to be cultivated from an early age.

The thorough drying and rubbing of the skin after the bath affords already some work to the arms and trunk, and this can be augmented by further exercises of the arms, legs and trunk before dressing again. We shall return to this subject in the chapter on the bath.

The *hands* of many persons do not receive sufficient attention. The stiffness and deformity of the hand and fingers, so often seen in advancing age, can be avoided to a great degree by judicious exercise and massage of the hands and fingers.

Those who possess fairly healthy organs of circulation derive more benefit from gentle *uphill exercise* than from walking downhill or on level ground. Also in weakness of the muscular fibre of the heart and moderate degrees of dilatation, graduated uphill exercise has a most beneficial effect (Oertel). It is scarcely necessary to remark that these suggestions as to walking uphill and other exercises are not intended for convalescents from acute diseases, and least so from rheumatic fever with recent heart complications, excepting under the most careful supervision.

This regular walking exercise, provided the health is fairly good, ought not to be interrupted by so-called *bad weather ;* it ought to be taken in all kinds of weather, rain or sunshine, cold or warm, day or night. Many people with a tendency to rheumatism or to catarrh of the nasal and bronchial passages, stay at home for weeks and even months ; as a result the nerves and blood-vessels of the skin, as well as the heat centre, lose their power of rapid accommodation to emergencies, the fighting power of the blood becomes impaired, and the pathological microbes get the upper hand. With proper protection by clothing, strong boots and umbrella, and changing the clothes if wet on coming home, walking in all weathers will not hurt, but will strengthen. The air is generally purer and freer from microbes during and after rain than at other times. Almost all fairly healthy persons become easily accustomed to every state of weather, and the tendency to rheumatism and catarrh from chills is either totally overcome by it, or at all events very much diminished, while the resisting power of the body is maintained and increased. This rule, however, requires some modification for those whose resisting power is much weakened either by disease, or long continued grave hygienic mistakes, or by old age. They, or at all events many of them, ought not to expose themselves to the fogs or strong cold winds often prevailing during winter and spring in most parts of Great Britain, but should either stay at home on the most inclement days and take extra indoor gymnastic and breathing exercises; or, if they can afford it, spend those seasons in warmer and sunnier climates, or at one of the sheltered localities of the southern or south-western coasts of England or Ireland. These localities ought to be provided with numerous divided open shelters where invalids suitably dressed can sit for hours in the open air without being exposed to cold winds and rain.

Since walking is one of the principal means for health and long life, we ought to keep the *feet* in a sound condition. Many people neglect walking because their feet become painful. The shoes ought to be of strong but not hard leather, ought to have thick soles, ought to be neither too tight nor too loose, but ought to fit easily and thoroughly in order to prevent corns and bunions. The same is the case with the socks or stockings; folds and creases ought to be carefully avoided, for they lead to corns and similar troubles. Corns and callosities ought to be attended by shields, by the knife, if necessary, and especially by pumice-stone. The chiropodist is often very useful.

DAYS OF PROLONGED EXERCISE.

Those who are still in fair vigour derive great benefit from taking regularly, once a week, *a day of more prolonged exercise*, up to three, four and six hours; and those who live in towns ought to spend this day of extra exercise in the open country, and, if possible, in a hilly district, since the mental exhilaration adds much to the utility of the physical exercise. The benefit of such a long walk is increased if only a very small quantity of food and fluid is taken during the walk; for instance, a sandwich or a few plain biscuits, and an apple or an orange. This is a matter of importance, for if the usual amount of food, and perhaps also fluid, especially alcoholic, is taken, the removal of waste substances and the renewal of tissues is not fully obtained. One of the visible effects of such a walk, combined with a very restricted intake, is that the body loses mostly between two and seven pounds during the walk. The amount of loss varies according to the condition of the walker, the duration of the walk, and other circumstances; as a rule, not without exceptions, large persons lose more than small ones; fat persons more than lean; those who are unaccustomed to long walks lose more than those who habitually take them; those who drink much before starting more than those who have taken only a small amount of fluid. A fast walk combined with some climbing leads to a greater loss than a walk at a slow pace and on level ground. The amount of, or the absence of, sunshine, the temperature, the relative humidity of the air, the presence or absence of wind, and other agencies, exercise considerable influence on the amount of the loss of weight. This loss consists almost entirely of water through the skin, the lungs and the kidneys, but with the water some salts and excretory substances are removed. The metabolism is activated and, by the increased removal of fluid and diminished supply of solid food and fluid, more used-up material is withdrawn, and the thirsty blood and starved tissues are enabled to take up more new material. The weight lost on the long walk is usually regained within two or three days. The *increased metabolism* and the *increased removal of waste products* are equally beneficial.

Many persons, including some medical men, are of the opinion that it is injurious to take much active exercise, especially in advancing years, that the body is sooner worn out by it than by rest or very restricted exercise. Some of my friends have often tried to dissuade me from my long walks, saying that they would "wear me out." They did not succeed, as I am sure that this "*wearing out*" theory is absolutely wrong. This theory has many adherents amongst well-to-do persons who are fond of ease and self-indulgence, who not only drive whenever they can instead of walking, but let themselves be dried after their bath and dressed by valets or ladies' maids, and who delegate on others all the work and exertion they can. They are greatly mistaken; by their life of inactivity their muscles waste sooner, and with this wasting their metabolism and heat-production become deteriorated, leading to premature senile decay. The animal body is not a machine made of dead substance, like wood or leather or stone, but is made of living organs and tissues which by action are not worn out, but nourished and maintained in working order, provided always that the exercise is not over-exercise. Many more people wear out too soon from *over-rest* than from *over-exercise*. In muscular work we have not to deal with a fixed sum of force, which, when spent, cannot be replaced, but the wear and tear of the muscle is more than compensated by increased supply and increased power to assimilate this supply and by the removal of the waste matter. Dr. Martin Luther's motto, "*Rast ich, so rost ich*" (If I rest, I rust), holds good for the body as well as the mind. Old persons accustomed to much exercise may go on taking it *as long and as much as agrees with them, and need not think of the number of their years*; but they must, on the one side, avoid over-fatigue, and on the other keep up the habit, if they wish to keep up their power; for if they leave off taking proper walks for some weeks or months, they frequently cannot resume them without injuring themselves, unless they do so very judiciously and gradually. In this respect there is a great difference between the old and the young. Young people who have been prevented taking active exercise by one cause or another can easily resume it; but in old persons the muscular fibre, the involuntary as well as the voluntary, has a great tendency to waste, unless it is kept in action, since the small nutritive vessels and the small lymphatics become atrophied by want of action.

Another advantage of several hours' exercise in the country is the exposure to the open air, which is scarcely to be overrated; it improves the oxygenation of the blood; it cheers the mind; it strengthens the skin and the nervous system, and through this the digestive system and the whole organism; it increases the *resisting power* to meteorological influences, and diminishes the liability to chills and other microbic affections; and this *resisting power* is one of the great factors of health and longevity. Life in the open air, by itself, even without exercise, increases the resisting power, and must therefore be arranged for delicate persons who are unable to take active exercise; it may be done by driving in open carriages or in bath chairs, by lying in hammocks, or by sitting and lying on well arranged flat roofs, in open verandahs, or in *open shelters*, such as now fortunately are being multiplied at most of the seaside resorts, and ought also to be abundantly supplied at all inland health resorts, in squares and parks and in private gardens. It is not for tuberculosis alone that open-air treatment is useful, preventive as well as curative, but also for almost all other chronic deviations from health and tendencies to disease, such as affections of the blood, especially anæmia, and of the nervous system, mental depression, and sleeplessness.

People to whom the so-called "walking without an object" is tedious must endeavour to find an object; I have often, for instance, succeeded in inducing patients, especially ladies, to take regular walks, by suggesting to them the keeping of dogs: they began to walk for the health of their dogs, and through this benefited their own health. When the dog scheme was not feasible I was not rarely lucky in awakening an interest in flowers, in botany in general, in zoology, and all objects of Nature, and in making them understand the ways by which open-air exercise and open-air life influence the health of body and mind. When persons know this, their knowledge stimulates their will; the will overcomes the dislike; and gradually the feeling of improved health and happiness leads to actual enjoyment of that which had formerly been drudgery to them.

Walking or Climbing Tours.—Still more beneficial than the once a week extra exercise is the plan of taking in addition, once or twice a year, *a walking or climbing tour of some weeks* [136] in mountainous districts, especially on or near glaciers, with four or more hours' active walking or climbing on most days of the week, provided that the organs of the body are free from disease, and that they be gradually accustomed to the increased work. The amount of benefit to be obtained from such tours, if judiciously arranged, can scarcely be exaggerated. They exercise an actually rejuvenating influence in which every organ and tissue of the body shares more or less. The power for mental work is increased, the view of life's duties and worries and hardships is corrected; the sleep becomes sounder; and repeatedly I have observed that the hair of the head and beard, when commencing to turn grey, has resumed, after good courses of climbing, more or less of the original colour. Frequently also I have seen that the abdominal girth is diminished, while that of the chest is increased, and that the respiratory or vital capacity of the lungs became augmented. The action of the heart is in all persons tangibly improved, in some to an astonishing degree. Again and again I have witnessed in many others and in myself that while before the climbing tour a slight exertion in climbing—about 500 to 800 feet—caused the pulse to rise from 60 or 65 to 110 and 130 and more, the same or even a much greater exertion—a climb of 3,000 to 4,000 feet—produced, after a mountain tour of some weeks, only a rise to 80 or 85. The pulse tracings by the sphygmograph are equally significant. Inseparable from the strengthening of the heart is that of the blood-vessels, especially the arterioles and capillaries, and lymph-vessels on which depends the improvement of the nutrition of all the tissues and organs of the body. The removal of waste products to which I have already alluded, as an important effect of all forms of exercise, is most thoroughly accomplished by these walking and climbing tours. I must, however, again lay stress on the condition that the different organs of the body must be sound if such climbing courses are to be undertaken. I have repeatedly seen great harm follow them in persons affected with diseases of the heart, the blood-vessels, the lungs, the liver, kidneys, or spleen, in various forms of diabetes, albuminuria and anæmia. For these, too, open air and exercises are very beneficial, but they must be carefully adapted to the individual condition ; over-exertion is to be strictly avoided.

Respiratory Exercises.—When reasoning about this remarkable improvement in the heart's action, and in the mental and physical conditions effected by climbing tours, I came to the conclusion that it was caused to a great degree by the deep inspirations which are induced by the act of climbing, especially steady and prolonged climbing. This consideration led me to pay particular attention to *respiratory exercises*, which since then have been very useful to myself and many of my friends, especially persons of sedentary occupations. By deep inspirations the entire lungs, including the apices and bases, become expanded, whilst in ordinary breathing the apices of many persons are only partially inflated. The blood and lymph flow in them is imperfect, and in consequence of being ill nourished they become the seat of disease, such as chronic catarrh and tuberculosis. In connection with this I may mention that in earlier years common colds usually led with me to long continued cough with purulent expectoration, but that since I practise the respiratory exercises, these colds remain confined to the upper portion of the respiratory tract and cause only slight cough of shorter duration and without purulent expectoration. Other persons have obtained similar results on themselves. I make no claim of originality for these movements. Although I have been led to them nearly fifty years ago by my own observations, including observations on myself, I gladly acknowledge that I have been forestalled in their publication by others, and especially by Dr. Harry Campbell's excellent work on "Respiratory Exercises in the Treatment of Disease" [22]. From various communications by Mr. S. M. Mitra I have further learned that a "breathing cure" has been practised in India for thousands of years, called by the Indians "Pranayam," which means the "regulation of vital energy" [84]. As in walking and other bodily exercises, the amount and method of respiratory movements must be adapted to the individual condition. It is often injurious in cases of great weakness of the heart or lungs, or the sequelæ of pneumonia or pleurisy, or after recent hæmoptysis, or other acute disease, especially rheumatic fever and influenza, to begin at once with forced respiratory movements. I have mostly commenced, even in healthy persons, with moderately deep inspirations and expirations continued during two to five minutes, and have gradually increased the exercises to ten minutes or a quarter of an hour or longer once or twice a day. The depth of each inspiration and expiration, and the duration of holding the breath, are likewise to be only gradually increased. At the beginning an eighth, or a sixth, of a minute for every inspiration and every expiration ought to be sufficient; if this is well borne, each act may be gradually prolonged to a quarter of a minute or more. I usually advise to begin inspiring in the erect position with raised arms and closed mouth, and to bend down the body during expiration so that the fingers touch the ground or the toes. The expiration may be made with closed or open mouth, but the inspiration must be made entirely through the nose (with the mouth shut), by which the air is moistened and warmed, and almost all the bacteria and macrocopic impurities are kept back by the mucus on the passage through the nasal cavities. The habit of nose-breathing ought to be adopted not only during the respiratory exercises, but also in ordinary breathing. Inspiring through the mouth ought to be entirely avoided. Shakespeare expresses his objection to mouth-breathing by making Casca say :—

> "And for my own part, I durst not laugh for fear of opening my lips and receiving the bad air."—
>
> Julius Cæsar, I, 2.

During the expiration the abdominal muscles ought to be thoroughly contracted not only in order to compress the contents of the belly, but also for the purpose of strengthening the muscles themselves. By degrees one can learn to make several up and down movements and various exercises of the arms, such as bending and stretching, or moving them about in a circle during every inspiration, and thoroughly bend and raise the body several times during each expiration. By this alternate bending and raising of the body we gain the additional advantage of strengthening the lumbar muscles, and through this successfully combating the tendency to lumbago. Another useful combination with the respiratory exercises is the turning of the body in the erect position round the axis of the spinal column alternately, with deep inspiration from left to right, and with expiration from right to left. The arms ought to be raised to the horizontal position, and thus are likewise strengthened. By these movements we bring into action, in addition to the lumbar muscles, some of the other muscles of the spine which are apt to be only imperfectly used by most persons; thus we keep the spine flexible, and prevent the stiffness of the neck and spine and the tendency to stoop, so common in old people. Another combination of breathing exercises with exercises of the legs is effected by placing the foot on a chair or other raised surface, and deeply inhaling with thorough bending of the joints of foot, knee and hip, and forcible extension of the leg with full expiration. A still further exercise by which the lower part of the spine and the muscles of the lumbar region are benefited we can practise by the bending of the body from the erect position to a right angle towards the right side with deep inspiration, and afterwards to the left with complete expiration, and repeating this ten or twelve times or oftener. Yet another combination is the swinging of the legs over a bar or a chair with alternate inspirations and expirations. Further combinations of deep breathing with muscle and joint movements will occur to those who have accustomed themselves to these respiratory exercises; but the latter ought always to have our principal attention, since to them the beneficial effect on the heart and lungs is mainly due. In addition to the influence on the nutrition of the heart and blood-vessels, the respiratory movements keep up the nutrition, elasticity and efficiency of the lungs, which are apt to undergo in old age a kind of atrophy. The *senile emphysema* which frequently occurs in old people is thus prevented. By improving the nutrition of the lungs we furthermore counteract the tendency to chronic bronchial catarrh and to pneumonia which are the most frequent causes of death in old age. Deep inspirations and expirations assist also in removing slight passive pleural effusions by acting as a respiratory pump. Another important influence consists in maintaining the *elasticity of the chest walls*, which are apt to become rigid with advancing age, and thus to interfere with the free movements of the lungs and the pleura. Intimately connected with the elasticity of the chest walls is the healthy condition of the rib-bones and their marrow, which greatly favours the formation of the blood globules. Another great advantage of these deep inspirations and expirations is that, through the contractions of the diaphragm, the liver and spleen and other abdominal organs are thoroughly massaged, the blood is squeezed out towards the heart, and the latter is forced to contract more vigorously; abdominal venosity is avoided. These respiratory exercises alone, or in combination with the other muscular exercises mentioned, are especially useful to literary workers, statesmen, professional men and others who are unable or disinclined to take other kinds of exercise. The most convenient times for practising them are in the morning before and after the bath, either naked or with only loose covering, and in the evening when dressing for dinner, or before going to bed. I must, however, repeat that the *energetic* breathing exercises are not suitable for very delicate persons, or certain morbid conditions; they are, for instance, injurious in great dilatation of the heart, although gentle, well-adapted movements have a beneficial influence.

It need scarcely be pointed out that by the improvement which walking and climbing tours and respiratory exercises effect in the nutrition of the tissues, they increase the resistance to disease, which is one of the most important factors towards the prolongation of life.

One often hears the objection that such

exercises take too much time, but most persons find that they are enabled through them, to work more energetically, to continue to work longer, and that thus are richly compensated for the time they spend on them.

Those who have to work six to nine hours in offices ought to go several times to an open window or balcony and take breathing exercises for about five minutes at a time. Many persons have told me that they can do more and better work by carrying out this plan.

Breathing exercises, and also other gymnastic exercises of a milder kind, are as useful for women as for men, and especially for those who take little active exercise. They ought to be practised by them without stays, which impede the free movement of the organs of the chest and abdomen.

Breathing exercises ought to be taken by the aged as well as the young. To *old persons* they are especially useful on account of their influence on the heart and lungs, which are inclined to fail in advanced age. They are also most important to those deprived of the power of walking. Such persons ought to take much breathing exercise while driving in bath chairs or carriages, or sitting out of doors, or near an open window, Very great was the benefit which I have observed, from carrying out this plan, in numerous cases.

We must, however, not restrict our lung-gymnastics to some minutes at a fixed time; but we must create the habit of always breathing not superficially but deeply, and taking besides several times each day for a few minutes extra deep inspirations and expirations, especially in the open air while walking or driving. At first we are apt to forget this, but it is not difficult to create this *habit of deep breathing*, the advantages of which are very great in improving the metabolism and the condition of the blood, in maintaining the resisting power of the organism, and thus preventing disease.

A very useful breathing exercise which is generally regarded only as a pastime is *singing*, even independently of its exhilarating influence on the mind.

Other Forms of Exercise.—These respiratory exercises, combined with movements of the limbs and trunk, are different from P. H. Ling's so-called "Swedish gymnastics;" but the latter are likewise most useful for the maintenance of health, and they can be adapted with numerous modifications, according to individual conditions, for many persons who are unable or disinclined to take ordinary walking or riding exercises. *Zander's* mechanical gymnastics, as practised in London, with valuable additions, by Dr. Hämel, can be most efficiently employed in exercising the different muscles and joints of the body. The so-called Danish exercises, and Schreber's gymnastics, Muller's and Sandow's exercises too, have many similar advantages, and also ordinary gymnastics as they are practised, under the name of "Turnen," although the latter are rather less suitable to old age than to the earlier periods of life, unless they are specially adapted to the more or less altered conditions of the aged body. The same may be said of military training, which forms one of the most beneficial means of development of nations, physical and mental. The Hindus have, in addition to their breathing exercises, various other forms of exercise for rendering the body supple. These exercises, which they call "Ashan," are very effective. All of them not only increase and maintain the muscular force, but strengthen the whole organism, and its *resisting power* against disease.

Another most useful exercise is *swimming*, which not only specially strengthens the skin and the whole muscular system, but also powerfully influences the entire metabolism ; it ought, however, to be avoided by the majority of aged persons, unless the organs of circulation and the kidneys are still sound. The effort demanded by swimming is less than that by hard running and other violent muscular exercises, and a *good* swimmer puts forth much less force than a *poor* swimmer. It will occur to everybody that much depends on the temperature and on the degree of motion of the water. If the water is warm, the organs of circulation and the kidneys are much less taxed than by swimming in cold water, and if the water is agitated, as is more or less the case in the open sea, the tax is very much increased. The most agreeable temperature for a swimming bath is between 72° and 80° F. The duration of the act of swimming and the temperature of the water ought to be regulated according to the condition of the body. The return of the warmth of the skin, the "glow," must appear during or soon after drying, combined with friction and muscular exercise. Swimming ought to be taught in all schools for girls as well as in those for boys.

Cycling has been strongly recommended by some men as a good form of exercise, preferable in many cases to walking; but apart from the rapidity of locomotion, the great majority derive much more benefit from the latter. In some instances, however, where the dislike to walking is very great, or where there is some defect in the feet or legs by which walking is rendered difficult, cycling is often a good substitute. The movement of the legs in cycling has also a beneficial influence on the abdominal muscles, and counteracts abdominal obesity. I have, however, seen a number of men, as well as women and children, who have become ill from over-exertion in cycling. The feeling of fatigue in cycling is perceived less than in walking, and therefore the danger of overstraining is greater in the former than in the latter form of exercise.

A very beneficial form of exercise for arms as well as legs, which involves a more or less prolonged and regular stay in the open air, occupying mind and body at the same time, is *Golf.*

Another kind of exercise requiring still more mental attention, more, in fact, than any other gymnastic exercise or sport, is *Fencing.* Every movement of the opponent requires to be constantly watched and acted upon instantaneously. At the same time it promotes the greatest precision and a certain degree of neatness of movement, and brings into action almost all the muscles of the body with the least expenditure of force.

Amongst the indoor exercises, playing *Billiards* has advantages to mind and body, especially to those who cannot or will not take active outdoor exercise; but the billiard-room ought to be better ventilated than it often is.

Angling is another pursuit to which many persons justly ascribe their health and happiness and long life. Izaak Walton himself, "the father of angling," lived to be 90. Long hours in the open air, with constant exercise, especially of the arms, with enjoyment of nature, and meditative contentment of mind, go far to explain this.

Gardening is likewise a source of health and long life to many persons. It can be made to include not only the cultivation of flowers, trees, fruit and vegetables, weeding, and similar light work, but also stronger work, such as digging, hoeing, mowing, repairing the paths, &c. It occupies the mind in an agreeable manner, and ensures a large amount of open air life. Gardening can be particularly recommended to ladies who are prevented from, or who dislike ordinary walking or riding or outdoor games.

1. Another convenient mode of exercise, especially useful in gouty people, recommended by Dr. Oliver, is what he calls the *static or tension exercises*, which consist in the static contraction of all the muscles of the body for one or two minutes several times a day in the standing position. In goutiness the arterial pressure is increased and the tissue fluid is prevented from returning to the blood, and lodges in the tissue vacuoles. Tension of the muscles diminishes the arterial pressure, and allows the tissue fluid to be absorbed. Dr. Oliver found that one minute's tension clears up as much as 20 per cent. of lymph. These tension exercises may be practised best an hour before all meals, when Nature itself produces a normal fall in the arterial pressure; but other times may be substituted, if more convenient.

The ordinary forms of *abdominal exercises* (*cf.* Dr. Leonard Williams, 144A, pp. 305, 306), are very useful for strengthening the muscles of the abdominal wall, and for opposing the tendency to so-called "abdominal venosity."

While recommending walking and climbing tours, and respiratory exercises, and various forms of gymnastics, I must guard myself against the indictment that I disregard the value of riding on horseback, rowing, skating, cricket, football, hockey, tennis, hunting, shooting, and many other kinds of sport. I, on the contrary, regard them as most useful to very many persons, female as well as male; but I am unable fully to enter upon them in this discourse. To all, *if properly exercised*, and excess be avoided, may be applied the Arab saying, "The days spent on the chase are not counted in life's course." We might even say that they add to the sum of life; or might quote Dryden's verses:—

> "By chace our long-lived fathers earn'd their food,
> Toil strung their nerves, and purify'd their blood."

In discussing different forms of exercise we must regard not only the perceptible contractions of the muscles and their connection with respiration, circulation, and metabolism, but also their developing the co-ordination by which eyes, body and limbs work together, and the powerful influence of many games and sports on the *formation of character*. Thus the boy learns already by his games at school that the vanquished foe must be treated not brutally, but generously, which will lead him even in warfare, not to frightfulness but to chivalry. Thus hunting promotes presence of mind, strength of will, courage and rapid decision; fishing develops observation, patience and perseverance, and similar advantages are associated with most other sports.

Before closing the chapter on muscular exercises, I venture once more to direct attention to their influence on the bones and the bone-marrow, since, I think, this is a matter of importance not sufficiently noticed. Each contraction of a muscle gives a pull at the bone to which it is attached; these pulls tend to promote the nutrition of the *bone* substance and the *bone-marrow*, and thus, as age advances, they are likely to diminish the tendency to senile fragility of the bones and to improve the formation of the blood, and its protective powers.

After this somewhat lengthened discussion it may be useful to sum up the principal points of the manifold influences of various muscular exercises on the health of the body:—

(1) Increased afflux of blood to the muscles.

(2) Promotion of the metabolism in the muscles and production of body heat.

(3) Increase of the fluid exchange between the tissues and the blood.

(4) Facilitation of the removal of the waste products.

(5) Maintenance of the elasticity of the thorax and lungs.

(6) The supply of abundance of oxygen for the blood and the metabolism.

(7) The keeping of all the organs of circulation from the heart to the smallest blood-vessels and lymphatics in a healthy condition.

(8) Action on the bones, leading to improved nutrition of the bone-substance and the bone-marrow, and through this to increased formation of blood corpuscles and furtherance of the protective functions of the blood.

(9) Strengthening of the resisting powers of the whole body towards diseases (partly owing to the improved state of the blood).

(10) The maintaining of a healthy condition of the brain and the mental faculties.

(11) All active exercises promote the circulation in, and the nutrition of the skin, and its powerful influence on the whole body.

VII.—THE DIGESTIVE SYSTEM, FOOD AND DIETETICS.

The *digestive system* and *food* require as much attention as the circulatory and respiratory systems.

The aim of dietetics or rational arrangement of taking food is to nourish the body, to maintain health, and to prevent disease by increasing the resisting powers.

Acting on the suggestion of some readers of the former editions of this lecture, I insert a short account of the principal articles of food, since the ideas of many well educated persons on the nutritious properties of the different kinds of food and their digestibility are often quite erroneous. I shall, however, restrict myself to a description of the average composition of foods and their relation to nutrition (without mentioning the number of calories represented by them), and refer to more complete treatises such as Koenig's [68], Rubner's [112], von Noorden's [92], H. Röttger's [111], R. Hutchison's [62], H. Snyder's [121], Halliburton's [50B], Chalmers Watson's [132], and C. E. Sohn's [121A].

We usually understand by *food* organic substances suitable for the maintenance or the increase of the body, and serving as sources of energy necessary for the execution of work and the formation of body heat (von Noorden). The ordinary constituents of food consist of proteins, carbohydrates, fats, different kinds of organic and inorganic salts and water; there are, besides, in the food substances other constituents such as extractives, condiments, ethereal oils, which are not regarded as necessary for the body, and the functions of which are not quite clear, but which may act as stimulators of various groups of cells, and may thus influence the metabolism (von Noorden).

Recent researches have further shown that most articles of food contain, in addition to the constituents mentioned, substances essential to life, but not yet accurately known, which are at present comprised under the term *Vitamines* (*British Medical Journal*, 1913, i, p. 722, Hopkins [55A], Funk [46B]). It is therefore not correct to judge the nutritive value only and entirely by the amounts of protein, fat, carbohydrates and salts of which they are composed. Different kinds of vitamines are probably contained in most articles of food in extremely small quantities, but in some parts in larger amount, especially in the pericarps of cereals and rice, in eggs, and in the brain.

The proteins, the mineral constituents and water are chiefly concerned in building up and in replacing waste in the cells, while the carbohydrates (glucoses, saccharoses, amyloses, pectoses) and fats are the chief energy-yielding and heat-producing substances, in which functions they are, however, greatly assisted by the proteins (R. Hutchison). The mineral substances, especially phosphorus and calcium and sulphur, play a much greater *rôle* in the nutrition of the cells and the metabolism of the body than is usually assumed, and still more so is this the case with the vitamines just mentioned.

A substance which is not considered as an article of food, without which, however, metabolism and life are impossible, is *oxygen*, which we take in by the air. The amount of air which we inhale is therefore as important as the amount of food which we consume, and both ought to be adapted to one another. One of the actions of oxygen is that it combines with the products of decomposition of the tissues and facilitates their excretion. It is to *Lavoisier* that we owe the greatest debt with regard to its rôle in the physiology of man and animals.

The nutritive value of different kinds of food depends (1) on the amount of proteins, carbohydrates, fats, vitamines, and salts they contain, and (2) on the amount of these matters which can be digested in the stomach and intestines and absorbed into the blood. As this amount is not the same in different persons (in other words, as the digestive and absorbent powers vary), the same articles of food need not have the same nutritive value for different individuals. Our knowledge of the action of various kinds of food on the organism is as yet imperfect. From experiments on animals, for instance, we learn that certain diets greatly lower their resistance towards certain poisons or diseases, but this important point is not yet sufficiently elucidated, and what we know we can apply to man only in a limited way.

We must preface the following account by stating that all food ought to be clean and free from substances impure to the body.

We derive our food partly from the animal, partly from the vegetable kingdom. The principal articles of animal food are the different kinds of meat and other flesh foods, eggs, milk and casein preparations. Under *flesh food* we may include beef, mutton, lamb, veal, pork, poultry, venison, game, the different kinds of fish, lobsters, crabs, oysters, snails, &c.; under *vegetable food*, the different kinds of grain: wheat, rye, oats, barley, rice, maize, buck-wheat, millet, &c.; almonds, nuts, haricot beans, peas, lentils, the green vegetables, tubers, roots, fruit and mushrooms.

Animal Foods.

The various kinds of *flesh food* are characterized by a large proportion of *proteins;* they contain, roughly speaking, about 25 per cent. of solids and and 75 per cent. of water; the solids consist of about 75 per cent. of albumin and 25 per cent. of gelatinous matter, extractives, fat and mineral substances. They are tissue formers, tissue repairers and great heat producers (Rubner). We may call them *animal* proteins, to which belongs also the protein of eggs. These *animal* proteins are superior in their functions as tissue formers and repairers to the *vegetable* proteins. All kinds of flesh food contain a certain proportion of so-called purin bodies, compound substances from which uric acid is formed. The composition of the different kinds of flesh food and their action on the body are not quite the same, but the idea entertained by many persons that so-called *butcher's meat* is much more liable to cause morbid changes in the metabolism, leading to diseases of the blood-vessels, gout, excess of uric acid, &c., than the so-called *white meats and fish,* and that these may be taken in much larger quantities with impunity, is not proved (von Noorden); and G. Oliver found the blood-pressure affected by the ingestion of white meats very much as by the ingestion of butcher's meats. I lay some stress on this point, because I have often found that persons suffering from gout, renal troubles, uric acid, stone, eczema, hæmorrhoids, &c., thought they might eat large quantities of poultry, game, venison and fish, if they only avoided beef and mutton, and that this erroneous view caused aggravation of their troubles. It must, however, be understood that a piece of broiled whiting is not equivalent to a piece of the same size of beefsteak, which is much heavier and contains much more protein and solids, and that therefore a larger sized piece of this lighter food may be allowed.

Although the different kinds of flesh food exercise a more or less similar influence on the metabolism of the body, it does not follow that it is to all persons the same, whether they eat half a pound of beef, or of mutton, or veal, or pork, or chicken, or fish. There are in this respect great differences in different persons, and even in the same person according to the state of health. There is, further, a wide difference in the digestibility of meat according to the age of the animal, the state of its nutrition and the way in which the animal has been fed or killed; or the part of the body from which it is taken, or the way in which it is prepared and cooked. The flesh for instance of very young and very old animals is less digestible than that of grown up but not old animals. As an instance of the difference which exists between different parts of the same animal, we may compare fat bacon with lean ham. A piece of a certain weight of bacon contains twice or three times as much fat as a piece of the same weight of lean ham (with an average proportion of lean and fat), and much less than half the quantity of protein and only very little purin. Flesh of the pig may serve also as an example to show the influence of preparing and cooking food; fresh pork, especially very fat pork, is to many people indigestible, while well-cured and well-cooked pork is easily digested by them. Properly cured and properly cooked ham, i.e., by long continued heat under 180° F., is perfectly tender, and requires much less time for digestion than ham quickly cooked in boiling water, or boiled or roast beef (especially when eaten cold). *Cold boiled bacon* is by the majority of people an easily digested article of food; not so fried bacon, which, owing to the changes in the fat produced by frying, frequently causes indigestion.

Mutton may be regarded as rather more easy of digestion than beef, and boiled neck of mutton is one of the most easily digested meat foods, much more so than leg of mutton.

Lamb, as a rule, is less nourishing and somewhat less digestible.

Veal is very different in different countries; it is rarely tender in England, while on the Continent, where calves are milk-fed, especially in Austria and the Tyrol, it is generally tender and easy of digestion. Veal and the flesh of all very young animals is richer in gelatine than that of the full-grown, and is, therefore, less suitable for those who want to build up rapidly a powerful muscular system for great muscular work.

Young chicken and turkey are easily digested, and the same is the case with game, such as young partridges, pheasants, grouse, and rabbits.

Roughly, we may say that tender and well prepared meats belong to the easily digestible and most nourishing articles of food. They do not, however, contain all the substances which are necessary for the maintenance of health, and must be supplemented by the addition of others, such as green vegetables and carbohydrates.

Meat extracts can scarcely be called ordinary food, although part of their nitrogenous constituents aids in the production of energy.

Different kinds of *fish* are differently borne by different persons. Whiting, sole, brill, smelts, pike, haddock, cod, and the more lean kind of fish are more digestible than the richer kinds, such as eel, salmon, mackerel, sardines and herring. The experience of Hippocrates still holds good, namely, that fish which lives in stagnant waters, or that is very fat, is hard to digest, but fish which lives near the sea-shore, is light to digest; also that boiled fish is lighter than fried. In cooking fish by frying, broiling and boiling, the exposure to heat above 180° F. ought to be only momentary, since otherwise the little flavour which fish possesses is destroyed. Steaming with water-vapour is preferable to boiling (Sir Henry Thompson). Fish cannot be regarded as a complete food, still less so than meat.

Oysters, when taken raw, are easily digestible to most persons, but not so when boiled. They consist principally of water, with some protein, fat, and carbohydrates. Their calorie value is very small compared with eggs and meat of the same weight. The possibility of contamination with typhoid or paratyphoid bacilli is always to be kept in mind.

The flesh of *lobster* and *crab* is dense and not suitable for delicate digestive organs, but it agrees well with some persons, of whom the late Emperor William I of Germany was an instance. Prawns and shrimps are rather more easily digested.

Turtle is in this country used almost only in the shape of soup. Its nutritive value is not so great as is generally assumed.

Eggs are to the majority of people easily digestible, but some persons cannot bear them, and on a few exceptional individuals who have an idiosyncrasy towards them, they act as a poison by causing heartburn, violent diarrhœa and vomiting. They are very nourishing. Hirschfeld calculated that a hen's egg of medium size has a nutritive value equivalent to nearly 2 ounces of lean meat, and to nearly 9 ounces of milk. They are more easily digested raw, or only slightly boiled, than when hard boiled. It is better to cook eggs by water heated not to the boiling point (212° F.), but only to about 170° F., which leaves the white of the egg in a jelly-like state; subjecting them for several minutes to the boiling point causes the white to become dense and hard. In this hard state an egg requires thorough mastication, for otherwise it is apt to lead to decomposition with excessive development of sulphuretted hydrogen and intestinal disturbance. The yolk is more nourishing than the white; it contains less water, more proteins, fat, and fat-like bodies (lecithin and kephalin, which enter into the composition of the brain and nerve fibres) and cholesterin and mineral matter, including iron and organic phosphorous compounds; the white is free from fat. The latter raw, or only slightly boiled, or cooked at a temperature of only 175° to 180° F., instead of 212° F., is by many persons more easily digested than the yolk. The late Sir J. Y. Simpson, of Edinburgh, the celebrated gynæcologist, was in the habit of restricting some delicate patients for many weeks and months almost entirely to the raw white of eggs, well beaten up and seasoned with a little salt, with great benefit to their health, a fact which I have been able to corroborate.

This experience, however, relates only to exceptional cases. For the majority of persons, it is more beneficial not to restrict themselves to either the yolk or the white, but to take the whole egg, white and yolk. The yolk is poor in potash and soda salts, the white is rich in them; the yolk is rich in phosphates, the white is poor in them; they supplement one another. Eggs have, to persons suffering from the uric acid diathesis, the advantage of being almost free from purin bodies. They are easily absorbed in the alimentary canal, and only a small proportion passes off with the fæces; hence they are apt to cause constipation, from insufficiently stimulating the intestines; they are also too poor in carbohydrates, and ought to be combined with other articles of food correcting this defect, such as brown bread, potatoes, green vegetables and fruit. They ought to be new-laid, not stale.

Milk is one of the most useful articles of food, we may even say the most perfect food, as it contains all the substances required for the building up and the maintenance of the body, including the mineral substances. Milk is easily digestible; it gently excites the glands of the stomach, and requires less gastric and pancreatic juice than other proteinaceous foods. Milk varies considerably, according to the condition of the cows, the way in which they are fed and housed. The sale of milk ought to be under the strictest supervision of the authorities, including the farm and its inhabitants, the condition of the cows, the milking, the milk cans, the transmission from the farm to the dairy in town, the arrangement of the dairy, and the supply to the public by the dairy. In addition to all this, however, the greatest care should be taken in the house of the consumer to avoid contamination by exposure to impure air, or cats, or rats, or mice, or flies, or the use of unclean vessels. Milk ought to be kept in a well-closed vessel and in a cold or cool place, in a refrigerator, if possible, in summer, especially for babies. Metchnikoff directed attention to the fact that milk gives rise in the stomach and intestines to the development of the *milk bacillus*, a friendly bacillus which combats the hostile bacilli in the intestinal tract, and thus counteracts putrefaction with its injurious consequences (auto-intoxication). This bacillus is also developed outside the stomach when the milk is allowed to stand and become sour. *Sour milk* is often declared as injurious, but this is by no means the case with the majority of people, who in fact bear it well. To Sir Thomas E. Fuller, the former Agent-General for Cape Colony, I owe the information that a kind of sour milk forms an essential article of food amongst Kaffirs, and that many Europeans, affected with various chronic illnesses, have lived on it almost entirely for long periods, residing with the Kaffirs, and have ascribed their recovery to its use. The question of taking milk boiled or unboiled must be answered principally according to the quality of the milk. If the milk is obtained from healthy cows, and is otherwise pure, it is to most persons more digestible, and also more nourishing, in the unboiled than in the boiled state, but if the purity is uncertain, it is prudent to boil it. The exposure to the actual boiling temperature ought, however, to be restricted to a few minutes, or even less. For most purposes it is enough to raise the temperature of the milk to about 60° to 70° C. (about 140° to 158° F.), and keep it at that temperature for about a quarter of an hour or a little longer. If milk is not consumed at once after such modified sterilization, it must be kept in a carefully closed bottle, since it becomes rapidly contaminated with microbes when left exposed to the air. We may assume that unboiled milk, like many other articles of food, contains a substance essential to the nutrition of the body, a *vitamine* (p. 80), which is destroyed by boiling. Strongly boiled milk may cause in some infants fed on it a kind of scurvy (Barlow's disease, named after Sir Thomas Barlow, who first described it). The disadvantages of boiled cow's milk may be avoided by using *goat's milk*, which is free from the tuberculosis bacillus, and otherwise less likely to be contaminated, so that it may be taken unboiled. *Cream* contains less water and casein and more fat than milk; if it is obtained by the centrifugal process, it contains more fat than that obtained by skimming. Cream is an agreeable food for fattening, but some persons must dilute it with water or lime water. *Devonshire* or *clotted cream* contains about double the amount of fat that ordinary cream does, and less sugar. *Whey* prepared with rennet contains the greater part of the milk-sugar, and the mineral salts of the milk, but only a small quantity of lacto-albumin; it is slightly nourishing and diuretic. *Buttermilk* is easily digestible; it is less nourishing than ordinary milk, as it has lost almost all the casein and a large portion of the fat, but it is still a valuable food owing to its milk-sugar and mineral substances, and is not sufficiently appreciated; it is also more diuretic than the whole milk. *Skim milk* contains more casein and less fat than ordinary milk, and is a cheap and good article of food when supplemented with carbohydrates, such as potato, maize, rice, and bread; it agrees better with most persons suffering from disease of the kidneys than unskimmed milk or cream. Skimmed milk may also be used with advantage in the making of bread by substituting it for water. The *milk-bread* thus obtained is more nourishing than ordinary bread, being richer in protein, and containing also a larger amount of lime salts, in which cereals are rather poor. Although milk contains all the substances required for nutrition, it is inconvenient for healthy adults to live entirely on it for a long time, since the bulk required is too large. If milk in its natural state causes indigestion, this can often be avoided by the addition of lime water (1 part with 4 to 6 of milk), or of Vichy water, or of citrate or bicarbonate of soda or potash, or of barley water or gruel. In some persons who say that they cannot digest milk, the cause is that they do not take it in the right way. They gulp it down rapidly, which tends to massive clotting in the stomach, while they ought to sip it slowly. To others it is indigestible, because they take too large a quantity of other food at the same time. *Condensed milk* is a fairly good substitute for ordinary milk, when the latter cannot be obtained. It is mostly not quite free from microbes, but almost so in the undiluted state; in the diluted condensed milk, however, microbes form rapidly. Condensed skimmed milk is less to be recommended.

Dried milk, prepared from entire milk, can likewise be used when mixed with six or seven parts of pure water, and also *dried skim milk*, but the latter is insufficient for infant food. The most useful milk food is known under the name of *Glaxo*, and consists of dried milk, with the addition of cream fat and lactose; it is the most like human milk of all the preparations sold as children's foods.

Koumiss is a fermented milk made originally in the Russian steppes from mare's milk, but now made also in various countries from cow's milk. It contains lactic acid and a small quantity of alcohol, varying according to the state of fermentation. It is an agreeably effervescing drink, and more easily digestible than ordinary milk for many people. *Kephir* (prepared from cow's milk) is similar to koumiss.

Butter is to the great majority the most easily digestible, and at the same time the most palatable of the fatty substances used as food. It is particularly rich in the fat necessary for metabolism. The amount of fat in butter varies; the average may be regarded as between 75 and 82 per cent., the remainder consisting of water and a small quantity of casein and milk sugar. When I speak of butter as easily digestible, I mean fresh butter, for on keeping it becomes rancid, and by some cooking processes, especially frying, it undergoes injurious changes. In this respect *margarine* has an advantage over butter, as it contains scarcely any fatty acids, and in consequence of this and of the absence of casein, keeps much longer and becomes less easily rancid. Although it has not the nice flavour of the finest kind of butter, it is a very good article of food, especially for cooking, and is much cheaper. The prejudice against margarine was unfounded, and it has justly found its way into the kitchen also of rich people. We must, however, bear in mind, as recent researches of Drummond and Halliburton show, that there are great differences between different kinds of margarines—that the *oleo-margarines*, prepared from beef-fat, can replace butter, while the *vegetable oil* margarines are not equal to it (*Journal of Physiology*, 1917, ii, p. 8). The most important function of the different kinds of fat and the carbohydrates in the animal economy is the creation of heat and energy; it may be said that the same weight of fat produces two and a half times more heat than either carbohydrates or proteins. The admixture of fat, therefore, allows the bulk of carbohydrates to be reduced. Although we cannot absolutely accept for man the results of dietetic experiments on animals, yet it is worth mentioning that Osborne and Mendel have found that the growth of young rats came to a standstill when the fat in their diet was lard, while rapid growth ensued when butter was substituted for lard. Butter, we may therefore infer, contains something, a kind of vitamine, which is necessary for the growth of rats, and which is absent in lard.

Cheese, another derivative of milk, is a compound of protein and fat, with some mineral matter; it varies considerably according to the way of making it. The odour and flavour of the various kinds of cheese are due principally to the kinds of ferment used and to the degree and stage of decomposition produced by bacterial action (ripening). Different bacteria produce different flavours. There are hard and soft varieties according to the degree of pressure exercised in removing the whey from the casein. If the greater part of the fat is removed from the milk and a *lean* cheese is produced (such as many of the Dutch cheeses, single Gloucester, Schabzieger and Parmesan are), it agrees better with persons of weak digestive powers, by being less apt to develop butyric and other fatty acids in the stomach. If all the cream is left a fatter cheese is produced, such as Stilton, Cheddar, double Gloucester, Cheshire, Gorgonzola, and Gruyère, and still more so if cream is added. Cheese is very nutritious, 1 lb. of cheese being equal to about two of beef, and even more; but it requires careful mastication, which is often neglected. In regard to the association of proteins with fats, the fatter kinds of cheese are richer than any other article of food. The softer varieties of cheese, like the different kinds of cream cheese, Brie, Camembert and Limburg, disagree rather frequently, if taken when already too much decomposed, but if they are taken fairly fresh and in moderate quantity, they are to most healthy people easily digestible. Cheese in the right degree of ripening, taken as a meal with bread, or potatoes, or maize, or rice, is well borne by the majority of persons, and is one of the cheapest and most nutritious articles of food. To many persons, especially of a gouty constitution, the substitution of a certain amount of cheese for flesh food is a wise proceeding, since cheese is free from purin, but, if taken at the end of a full meal, it often disagrees, and cannot be recommended, since the powers of the digestive organs are already taxed to their limits.

Dried casein can be used in soups, with macaroni and other dishes; it is the principal constituent of *plasmon*, *sanatogen*, *nutrose*, *casumen*, *eucasin*, and other nourishing preparations, combined with small quantities of alkalies, especially soda and ammonia. One of their merits is, that they contain phosphorus in an organic combination with albumen which is readily absorbed and enters into the nutrition and metabolism of the cells of the body, as shown by the experiments of Beddoes and others with sanatogen (casein-sodium glycerophosphate).

Gelatin.—Under the heading of animal foods we must give a place to gelatin, which is produced by the boiling of skin, tendons, bones, cartilages, and other animal substances. Gelatin is chemically allied to the proteins; it contains many of the units of meat protein, but in different relative amounts, and it lacks tyrosin, cystin and tryptophan. It cannot, as far as we know, be built up into living fibre, such as muscle. It can, however, as a sparer of meat and protein, be utilized in the form of jelly, soup and beef tea, especially in febrile diseases, when ordinary flesh foods cannot be digested.

Vegetable Foods.

Greater than between animal foods is the difference between the various kinds of *vegetable foods*, both as to their chemical composition and nutritive value and as to their other influences on the organism. On the whole, they are less rich in proteins, but are the principal furnishers of carbohydrates, particularly in the shape of starch, dextrin and sugar, and also of vitamines. The majority of the vegetable foods, excepting the nuts, almonds, olives, and oil-bearing substances, contain less fat than the animal foods. Another characteristic constituent of vegetables is the *cellulose* by which most of the carbohydrates are surrounded, and which necessitates the dissolving action of cooking and the digestive processes that effect the transformation of the carbohydrates into absorbable substances. Although cellulose cannot be transformed by the digestive ferments of man, and cannot be called nourishing, it is useful in the process of nutrition to animals living on vegetables or, like man, on a mixed diet. It induces intestinal peristalsis by mechanical stimulation and thus assists the important function of defæcation. Many of the vegetable foods, especially fruit and green vegetables, are further characterized by various vegetable acids, and amongst the saline constituents, by a larger proportion of potash salts, which are of importance in the metabolism of the body. Among the characteristics of vegetable foods, it may be mentioned that the proteins contained in them are less prone to putrefaction in the intestinal canal than those of flesh foods (Tissier); this constitutes a point in favour of vegetable foods. Moreover, the proportion of nucleo-proteins in them is smaller.

The most important group of the different vegetable foods is formed by the *cereals*, the principal representatives of which are wheat, rye, oats and barley. They contain proteins and carbohydrates, vitamines, some fat, cellulose and mineral matters, including phosphorus and iron, in fact, all the constituents of the human body. Wheat and rye are of the greatest interest to us, as bread, one of our staple articles of food, is prepared from them. In England, almost only wheat flour is used, while in Germany, Denmark, Sweden, &c., rye bread (black or grey bread) was in former years eaten by the greater portion of the population, wheat bread (white bread) only by the richer classes; gradually, however, the use of white bread made from wheat, or of bread made from a mixture of rye and wheat flour, has, there too, become more general. Rye bread contains a much larger amount of cellulose, and, owing to this, a larger proportion passes through the bowels unabsorbed, than of fine white bread; it is, therefore, weight for weight regarded as less nourishing than white bread. On the other hand, rye bread does not become dry so quickly as white bread, and keeps longer fresh—an advantage in some rural districts, where bread is, or used to be, baked only once or twice a week. It acts rather more on the bowels than white bread. We must also take into consideration that the flour of rye contains more organic phosphorus compounds than fine white wheat flour, a fact which is of great importance to the nutrition of the body. It is not correct, though it is generally done, to calculate the nutritive value of bread merely by the proportion of proteins and starch without considering the presence or absence of vitamines.

There are a great many kinds of bread, differing according to the quality of the corn, the fineness of the flour, the manner of preparation, and the removal of parts of the corn, such as the bran and the germ, or the addition of other substances. We cannot enter into a description of the different processes of baking or the numerous kinds of bread, but must say a few words about so-called *brown bread* as compared with the different kinds of white bread. *Graham*, as far as I know was the first who, in a scientific way, brought the advantages of using, in the preparation of bread, all the constituents of the wheat—the bran, as well as the fine flour of the centre—before the public. Hence the term "Graham Bread" was used on the Continent for whole wheat bread. Since Graham's time it has been found that the removal of the outer layers of the grains of rye, wheat, rice and barley may cause polyneuritis, beri-beri, or a kind of scurvy, in those who live entirely on the finest part of the flour or on "polished" rice. Feeding experiments on animals by various investigators have corroborated this (cf. Leonard Hill and Martin Flack). The loss of the greater part of the mineral matter was regarded as the cause of these troubles, since the addition of bran to the food removes them; but the loss is not limited to the mineral matters. We may assume that the bran with the part of the corn closely attached to it contains substances called vitamines (see back), necessary for metabolism and life, and that the plan of taking only the finest white bread, and using principally the finest white flour is injudicious. Henry J. Hibbert has recently discussed this subject in the *British Medical Journal* ("Bread for children," March 4, 1916).

Not all kinds of brown bread, however, are the same. The majority of bakers mix a varying amount of bran with white flour, not always in a fixed proportion, while Graham wanted the bread to be prepared from all the constituents of the whole corn—"wholemeal bread" or "wholemeal wheaten bread."

The late Sir Henry Thompson has given a good prescription from which some bakers (Stewart and Spiking) make a very palatable bread (Thompson's wholemeal bread). This kind of bread is nutritious, easily digestible to most people, and helpful in assisting the action of the bowels. Some persons, with an irritable mucous membrane, or with suspected ulceration in the stomach or intestines, ought to use a bread prepared from a finely ground corn, which, however, ought to contain the germ and part of the bran. A larger proportion of brown bread passes off with the fæcal matter than of white bread, owing to the great amount of cellulose contained in the bran; a rather smaller proportion of brown bread is absorbed than of fine white bread, and brown bread is therefore considered by many persons as less nourishing. This view, however, must be taken with reservation. There are, no doubt, as the experiments alluded to show, substances in the outer part of the grain which are necessary to the nutrition of the body (vitamines), and those are absent in the finest white bread. In the mixed diet of most persons bread forms only a part of the food, and the substances referred to are contained in the other parts of the food, so that their absence in the bread consumed has no noticeable bad effect. Considering the advantages and disadvantages of white and brown breads, the advantages of the latter (Graham's and Thompson's bread) predominate for a large proportion of people; this, at all events, is the result of my experience after long continued observation on a great number of persons. Most persons with sluggish intestinal action derive much benefit from it, while those with perfectly regular action of the bowels may give the preference to white, or better, household bread, if it is more appetizing to them.

In some parts of Germany, especially in Westphalia and in the German Army, a kind of wholemeal rye bread is used, which is very different from the English wheaten brown bread; it is dense and heavy, but when thoroughly baked and well masticated, it is digestible and nourishing. As about forty to fifty per cent. of this bread, often called "Pumpernickel," passes off with the fæces, the food value is inferior to that of the English brown and "standard" breads. The so-called "Kommisbrod" variety of this "black bread" is what has been so much complained of by the English and French prisoners in Germany.

Bread, although an excellent article of food, is not quite as perfect as milk, but combined with the latter, it is sufficient for the nutrition of the human body. It is easy of digestion, if properly baked, if not eaten too fresh, and if thoroughly masticated. Biscuits, rusks, and toast are still more so, since owing to their dryness more perfect mastication is necessitated, and through this the secretion of an increased amount of saliva, so important in the digestion of farinaceous food, is effected.

There are several other preparations of wheat in use which are easily digestible and nutritious. The best known are macaroni, semolina, florador, granola, and Allenbury's foods. In addition we may mention "shredded wheat," "force," and "grape-nuts," which are made of whole wheat already submitted to a cooking process, so that they can be eaten without any further preparation.

Oats are relatively rich in protein, fat, and mineral matters, and are very nutritious if well ground or rolled. Owing to the want of gluten, they are not quite suitable for making bread; but the different preparations in commerce, such as oatmeal, Quaker Oats, Waverley Oats, Veda Oatmeal, groats, &c., yield when well cooked, excellent porridge and similar dishes, which, combined with milk and its derivatives, offer all that is required for nutrition. Oatmeal ought to be thoroughly boiled, but this is often imperfectly done. For some persons with a tendency to constipation oatmeal has the merit of acting gently on the bowels. *Porridge* (oatmeal porridge) made with milk is easily digested and nutritious, and the same may be said of well baked oat cakes. It is to be regretted that by the working classes tea and

Bread and potatoes are now commonly substituted for porridge and oat cakes, since the latter are superior in food value and cheaper. Gouty persons, however, ought to be moderate in the use of oats, on account of their containing more purin than other cereals.

Barley forms a most useful article of food in the form of barley soups, barley porridge and barley cakes, though it contains rather less protein than wheat. It is likewise not quite suitable for making bread, as it is poor in gluten; but by the addition of wheat flour it yields a fairly satisfactory bread. Barley is richer in mineral matter than any of the other cereals. Barley water contains not much nourishment, but is a useful beverage in many cases of illness.

Different from the cereals just mentioned is *maize*, which contains rather less protein and less mineral matter, but much more fat than wheat. It cannot be used for bread owing to its want of gluten, unless mixed with wheat or rye, but it is easily digestible, and has much nutritive value. The numerous preparations in use, maizena, cornflour, oswego, hominy, &c., form excellent puddings, but their nutritive value differs considerably; hominy is the broken down maize corn and has its full nourishing power, while in oswego, cornflour and maizena the protein and fat have been washed out, so that they consist almost only of starch. Maize, deprived of the cuticle, *polished maize*, is an insufficient food, and is suggested to be the cause of *pellagra* (cf. Funk [46B]) just as "polished" rice may be the cause of beriberi. I have often come in contact, in the Swiss and Italian Alps, with natives of Upper Italy, principally of the district of Bergamo, who for three or four months every year lived entirely on *polenta*, milk and cheese, doing, as shepherds, much active work and enjoying perfect health. The addition of milk and cheese supplements the relatively small proportion of protein contained in the maize that they eat in the form of polenta. These shepherds consumed on an average per day and per individual one and a half to two pounds of maize flour, four to six ounces of cheese, and a pint of milk. They prepared their polenta from the yellowish flour of the whole corn, not the white flour from the interior of the corn, which they had found less nourishing.

Rice contains much less protein than wheat, rye, oats and maize, aud very little fat, but is richer in starch. If well boiled, which is essential, it is easily digested and almost entirely absorbed, but for perfect nutrition it requires the addition of other articles of food containing protein, fat and mineral matter. The experience of man and the experiments on animals, referred to above, show that a disease similar to beriberi is produced in animals entirely fed on *polished rice*, and that this disease is removed by adding the husk or pericarp, or the extract of it, to the rice meal.

Millet is rarely used in Great Britain, but much more so on the Continent. Its composition is similar to that of other cereals, but it is poorer in protein, and it contains a relatively rather large amount of silica.

Buckwheat is not properly a cereal, but constitutes a good article of food in Holland and several parts of Germany and America, in the form of a kind of porridge and cakes (griddle cakes, &c.).

Another important class of vegetable foods, comprised under the term of *pulses*, is represented in our dietary by dried *lentils*, *peas* and *beans* (haricot and broad beans). There are some differences between them, but they have in common a large amount of a variety of protein named *legumin* or *vegetable casein*; they have a smaller proportion of carbohydrates than the cereals, and are poor in fat but rich in salts, especially lime and potash. They are very nourishing, but require a strong digestion. It is also to be noted that on account of the cellulose of the vegetable cells not the whole amount of the protein which the pulses and other vegetable foods contain is utilised. Voit stated that about 42 per cent. of the nitrogen consumed by pure vegetarians is discharged with their fæces; while nearly the whole of the protein of tender meat, or eggs or cheese, is absorbed from the contents of the bowels. Owing to their containing much sulphur the pulses are apt to give rise to flatulency; lentils have this disadvantage in a lesser degree. Pulses require long and thorough cooking. If given in a state of fine division, as in soups, a much larger proportion of protein is absorbed. They ought to be taken together with other kinds of foods such as bacon, milk, green vegetables, fruit, &c., and only sparingly by persons of sedentary habit, and those of gouty disposition, since they are comparatively rich in purin.

The *soy* or *soja* bean, which is much used in Japan and in China, is of all pulses the richest in protein, but is poorer in carbohydrates.

The various kinds of *nuts* and *almonds* contain a fair amount of protein and a large proportion of vegetable fats, which by vegetarians are used instead of milk-butter, lard, and other animal fats. The nutritive, substances are enclosed in such dense cellulose that they require very thorough mastication to transform them into a semi-fluid material; as this is often neglected, they prove to many persons indigestible. Great progress, however, has been made of late in producing from nuts and almonds various articles of food, which are nutritious, palatable and digestible, and which may take the place of animal foods.

In the south of Europe *chestnuts* form a valuable article of food. They are rich in carbohydrates and possess a fair proportion of proteins. Well cooked, they are easy of digestion to most healthy people.

Green vegetables are rich in water and in cellulose, but very poor in nitrogenous matter, in carbohydrates and fat, but they contain in addition to cellulose a relatively large quantity of mineral matter, such as potash (combined with vegetable acids), lime, iron, combinations of phosphorus, and vitamines, which render them useful and anti-scorbutic. By cooking they lose part of their salts, and take up water, so that some cooked vegetables contain only 1 per cent. of solid matter and 99 per cent. of water. They are not easily digestible for the majority of persons with weak stomachs; but much depends on the process of cooking and on their being fresh or stale; vegetables fresh from the garden are much more digestible than stale ones bought on the market. The different forms of cabbage, brussels sprouts, cauliflower and salsify belong to the more nourishing kinds, but cause in many persons flatulency. Boiled in salt water they are more palatable than when boiled in ordinary water. The leafstalks of celery, cooked lettuce, endive and vegetable marrow are much less nourishing, but are well borne by a large number of persons. Spinach, which contains more iron than most vegetables, is, to the majority of persons, a very useful vegetable, and similar to it is chicory. Green beans require thorough cooking, and not less so young or green peas and broad beans; peas and broad beans, when they become older and more mealy, partake of the character of the pulses (above mentioned). Asparagus is fairly well digested by most people, but ought to be taken only sparingly by most gouty subjects, on account of the purin it contains.

All green vegetables are bulky, and much of their substance, besides the cellulose, passes unabsorbed through the alimentary canal; they are therefore not very nourishing, but they assist defæcation much more than meat foods and those vegetable foods which have only a small amount of cellulose and are rich in starch, such as potatoes, macaroni and white bread. Green vegetables are thus suitable to persons with sluggish intestines.

Salads, made of some uncooked vegetables and fruits, from lettuce, endive, cress, tomatoes, &c., are refreshing to most healthy persons, but not suitable to the majority of those with delicate digestion. The greatest care ought to be taken in cleaning, in order to remove microbes and the eggs of parasites.

Onions, the favourite vegetable of the inhabitants of southern Europe, contain a comparatively large amount of sulphur and are apt to cause flatulency in the more northern climates, where the habits of people are different; they ought to be avoided by persons with weak digestion or taken only very sparingly.

Garlic, allied to onions, contains more protein and carbohydrates and less water, and has therefore greater nourishing value, but is to most persons intolerable on account of its strong smell and taste, except as a flavouring addition in minute quantities.

Vegetables with much oxalic acid, like *rhubarb* and *sorrel*, ought likewise to be taken only sparingly by the majority of persons. Stewed rhubarb leaves are a favourite dish with many persons, but in some they cause more or less severe griping pains. The leaves contain much oxalic acid. The harmful matter seems to be contained less in the stalks of the leaves than in the blades.

The nourishing value of green vegetables, as just stated, is very small compared to that of meat, cereals and pulses, but their vegetable acids and saline constituents are useful, especially the potash salts, which help to keep the blood alkaline; they are therefore specially suitable for persons with tendency to gout, stone, and some skin affections. Owing to the large amount of cellulose contained in green vegetables only a small portion is absorbed, while a larger portion passes off with the fæcal matters, giving them bulk, and stimulating the intestines, and thus, to some degree, counteracting constipation.

Amongst the *roots* and *tubers* used as food, the most important is the *potato*, owing to its large amount of starch, combined with a small proportion of nitrogenous substance, salts and extractive matters. Only a part of the nitrogenous substance is protein; nearly half consists of non-proteins, amongst which *asparagin* takes a large place, which, though unfit for building up muscle, is credited to be a protein-saver by counteracting the putrefaction of proteins in the intestines. Potatoes form a valuable article of food, when combined with other nutrients which contain more nitrogenous matter and fat, such as milk and cheese, and fleshy foods. They are easily digestible when well prepared, thoroughly cooked and well masticated. Mealy potatoes are preferable to waxy, which is the quality of most new potatoes. Steamed, roasted or boiled in the skin, they retain most of their nourishing material; but when boiled without the skin, they lose much of their nitrogenous and saline ingredients, firstly, because a large proportion of these ingredients is contained in the layer situated immediately beneath the thin cuticle and is removed with it; secondly, because a part goes to the boiling water. Passed through a fine sieve or potato-masher, or in the form of thick soups or mashed potatoes, they are mostly well borne; but fried in thin chips they are indigestible to many persons. The important anti-scorbutic value of potatoes is well known (see back, in regard to "vitamines").

Amongst the *non-starchy roots*, turnips, carrots, beetroots, parsnips and Jerusalem artichokes are much used; they are characterized by a large amount of water, a moderate quantity of carbohydrates and salts, and a very small proportion of nitrogenous matter. They form for healthy persons a useful admixture with other articles of food, especially flesh foods and cheese. *Salsify* and *scorzonera* (black salsify) differ from potatoes in their greater protein-contents and in their smaller proportion of carbohydrates; they are easily digestible when well boiled, and deserve greater appreciation than they generally receive in England.

Arrowroot and *tapioca*, obtained from roots of plants in the West Indies and South America, consist almost entirely of starch, and are of value in some intestinal derangements, but cannot sustain life for any length of time, without the addition of other food. The same may be said of the palm starches, represented in England by *sago*, which, however, contains a little more nitrogen.

As a product of vegetables rich in carbohydrates we must especially mention *sugar*, which is the purest carbohydrate food. In moderate quantities —of 1 to 4 oz. a day for adults—it is easily digestible to most healthy persons, though it disagrees with a minority by causing rapid fermentation in the stomach and small intestine. In most persons with a tendency to corpulence, sugar, as well as foods rich in starch, are to be avoided, for it is certain that in the human body carbohydrates can be transformed into fat, although this may be difficult to explain chemically. Sugar is called by some authors a muscle food, but this term leads to misunderstanding, as it cannot be actually built up into muscle, but it produces *energy* and *saves* the muscle during exertion. I have often found this in myself and my companions in climbing. When unprovided with tea, or coffee, and when our strength began to flag, a few lumps of sugar helped us on wonderfully. Large quantities of sugar, however, when taken together with a full amount of animal or mixed food, prevent thorough metabolism of the proteins, and lead to diseases, such as gout, uric acid concretions, diabetes, and indirectly also arterio-sclerosis.

Sugar alone is an insufficient article of food, like the other carbohydrates. They can for a restricted period form a substitute for proteins and maintain the organism, but the addition of proteins, in one shape or another, is absolutely necessary to keep up the equilibrium of health, although the quantity may be small.

Honey is composed of about 75 per cent. of invert sugar, 3 per cent. of cane sugar, about 15 per cent. of water, the rest being wax and flavouring substances from flowers. It acts in the body like sugar, but has, however, in most persons, a slightly aperient effect ; in a few it causes colicky attacks of diarrhœa. It was highly appreciated as an article of food in ancient times, and Galen tells us that Antiochus, a famous physician who lived to very old age, took every morning on the forum of Rome, about 9 to 10 o'clock, at his breakfast, some bread and boiled honey, and that the breakfast of Telephus the Grammarian, who lived to almost 100 years, consisted of honey from the comb mixed with gruel. Some persons, well known to me, ascribed their health to the regular use of honey at breakfast.

The different kinds of *confectionery* ought to be regarded less as articles of food than of relish, and ought to be taken only in small quantities.

Starch, which is widely distributed in vegetable foods, especially rice, maize and cereals, and roots, including potatoes, is, like sugar, a most valuable nutrient; it is transformed in the body into dextrin and sugar and somehow into fat; but it is as little a perfect food as sugar or fat.

The different kinds of *fruit* are mostly characterized by a large amount of water (80 to 90 per cent.), a very small percentage of protein, a varying quantity of sugar (about 4 to 10 per cent.), some vegetable acids (malic, tartaric, citric and acetic, and traces of benzoic acid in cranberries, bilberries, and huckleberries or whortleberries), a small quantity of starch (in some fruits only), mineral substances (potash, soda, magnesia, iron, phosphorus), more or less cellulose, and probably a varying quantity of vitamines. Their digestibility varies according to their ripeness and the amount of acids and cellulose. *Ripe* and *tender* apples, pears, grapes, currants, gooseberries, strawberries (rich in potash), blackberries, cranberries, bilberries, raspberries, figs, cherries, greengages, plums, apricots, oranges, peaches, melons, bananas and tomatoes, are to most healthy people easily digestible, if taken in moderate quantities, but not when the stomach is already filled with other food, as it often is after lunch and dinner. They are most suitable with a simple breakfast and a small lunch. Many people improve their health by always taking at breakfast soft raw apples,[1] peaches, grapes, oranges, melons or pears, but attribute the greatest value to *apples*, the acidity of which assists the action of the gastric juice; it also stimulates the pancreatic gland, the secretion of which acts as a solvent on almost all food constituents.

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[1] *Apples* have an old reputation for wholesomeness. Thus *Laurentius* [70*], to whose work Sir William Osler has directed my attention, when speaking of permitted fruits, says: "and especially those apples which have a marvelous

Several fruits, like strawberries, have a disagreeable effect on some people, causing urticaria, eczema, and gouty symptoms. Many persons suffer from flatulency and diarrhœa after raw fruits, while they are able to bear them much better cooked. By cooking, however, part of the fruit salts is lost, and with them some of the usefulness. In apples this can to some degree be avoided by simply baking them in their skins, but even in this way they lose some of their aperient action. It is assumed that apples as well as other fruits and vegetables contain in their raw state a kind of enzyme which is destroyed by cooking (cf. back, in regard to "vitamines"). To many persons, therefore, the use of raw fruit is preferable.

Many people think that fruits, green vegetables, roots and tubers are of little value for the nutrition of the body, because they contain so small a quantity of protein; but they are very useful by their fruit acids, which in the body are transformed into carbonic acid, and by their alkaline bases, principally potash, which combine with the excess of acid from flesh food, cereals and pulses. Some

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propertie in curing melancolie." There may be some foundation in this statement, since apples by their aperient effect assist removal of fæcal matters, and thus prevent auto-intoxication. Apples contain a larger proportion of soda salts than pears, which are richer in potash salts.

fruits, however, contain a much larger amount of nourishing materials than others. Thus, fresh bananas contain about 22 per cent. of carbohydrates and 1·5 per cent. of protein; dried figs, between 60 and 70 per cent. of carbohydrates and 3 to 4 per cent. of protein; dried dates, over 70 per cent. of carbohydrates and 2 per cent. of protein; dried raisins, 70 to 75 per cent. of carbohydrates. These fruits require only a small addition of foods such as milk, bread, or cheese, to enable them to maintain life.

It is of great importance with regard to fruit, to avoid the introduction into the body of impurities—microbic and parasitic—attached to them. With some, such as oranges, apples, pears, peaches, bananas, this can be avoided by peeling them, but with others, such as raspberries, currants, especially strawberries, &c., it is difficult to escape some degree of danger, except by the greatest care in washing them, and even this does not give perfect safety. The same is the case with green salads and other uncooked green vegetables.

Jams are the products of different kinds of fruit boiled together with sugar. Some of the aroma of the fruit is lost by the process of boiling. Jams are, in moderate quantities, easily digestible, and give a relish to bread. *Marmalade* from Seville oranges is perhaps the most useful kind of jam.

Candied fruits are not very digestible.

Mushrooms (fungi) form in most countries only a small item of food-substances; their nourishing value is overestimated, though they have a larger proportion of protein than most fruits and vegetables. Mushrooms may be more appreciated for their flavouring than their nourishing qualities. The best known kinds in England are the common mushroom (*Agaricus campestris*), the *Boletus edulis*, the *Lactarius deliciosus*, the *Cantharellus cibarius*, and the Morel (*Morchella esculenta*).

The various kinds of *spices* (condiments) such as mint, mustard, pepper, nutmeg, caraway seeds, fennel, dill, ginger, allspice, vanilla, cinnamon and cloves, are to most healthy persons unnecessary; they cannot be considered as articles of food but are in moderate quantity useful to many people, especially persons with delicate appetite, by exciting the secretion of the digestive fluids and increasing the appetite. They also stimulate the contraction of the muscular fibres of the coat of the stomach, and relieve flatulent distension. The habit of taking large quantities of mustard and pepper cannot be recommended. They often cause a kind of catarrh of the throat and stomach (spice catarrh, catarrhus condimentosus) which disappears after the discontinuance of spices.

Vinegar is different from condiments; it assists the digestibility of food by softening the fibres of tough meat, and the cellulose of green vegetables in salads and pickles. It is besides an excitant of the gastric glands and of the pancreas.

Inseparable from food, and essential to the nutrition of the animal body, is *common salt*, (chloride of sodium). Almost all foodstuffs contain certain quantities of common salt as well as other salts (of potassium, calcium, magnesium and iron) which form part of the animal body, and only few articles (amongst them eggs, potatoes, rice, and fresh-water fish) require an addition of salt. The adding of a small quantity to soups, eggs, fish, &c., is not injurious, and is to many persons useful, since it renders some food substances more palatable, which is an important point; but the *habit* of adding large quantities of salt to all articles of food cannot be recommended. The excess may be harmless to some persons, but is injurious to others, especially to those suffering from renal disease. In such cases one often sees the disappearance of dropsy result from a comparatively saltless diet, which need not be monotonous if there is a choice from milk, fresh butter, eggs, fresh water fish, fat bacon without the lean, potatoes, maize, rice, lentils, peas, green vegetables, fruit. In most people with a tendency to eczema, this tendency is increased by the use of much salt. Large quantities of salt increase the blood-pressure and are therefore likely to promote the development of arterio-sclerosis. Where there is high blood-pressure the use of salt ought to be restricted.

The *drinking water* deserves more consideration than it usually receives. Water may be regarded as a nutrient, since it forms a large part of the human organism (about 63 to 70 per cent.). The intake of a certain quantity is absolutely necessary as a solvent and diluent for the various processes of nutrition, metabolism and excretion. The amount required for an average person under ordinary circumstances is about 3 to 5 pints in the twenty-four hours. A great part of this is, however, not taken in the shape of drinking water, but is contained in the various articles of fluid and solid food, soup, green vegetables, fruit, milk, tea, coffee, wine, and beer.

The quantity of water required varies considerably according to the external temperature, the force of wind, the humidity of the air, the amount and nature of the work, the quantity and quality of the food, &c. To many persons the time when the water is taken is a matter of importance. Obese persons or those inclined to undue *corpulence*, ought not to drink at meals, but ought to take the fluid they require apart from meals, night and morning or an hour before or after meals. Also many others, who are not fat, digest their meals better when they take them dry, and all ought to avoid much fluid at meals. A glass of water, cold or hot, according to circumstances, at bedtime and in the early morning, is very useful to most, and especially to gouty, persons. The removal of waste products and toxins is assisted by this habit.

Amongst the many popular cures for corpulency, one of the most useful and least hurtful is to take occasionally for four or five successive days a large quantity of water, about 8 to 10 pints, cold or hot, according to the nature of the case, but always apart from meals. This so-called *flushing of the system* may be carried out once every three or four weeks, or with longer intervals.

I cannot enter fully into the composition of the water, but may say that the water ought to be quite or almost free from organic, and should contain only a small quantity of inorganic, matter. The fear that soft water or rain-water properly collected and stored, kept free from impurities, is injurious, is unfounded, but rain-water collected in large towns is rarely pure and ought to be filtered and boiled, a remark which was already made by Hippocrates. Hard waters, containing much sulphate or carbonate of lime, lead in some persons to constipation, and in some to urinary concretions; they possibly also favour the formation of gall-stones, and mostly aggravate gouty conditions. They therefore ought to be avoided. The water arising from granite, gneiss and sandstone agrees best with most persons. There may be active elements in some waters which are still imperfectly known, such as radio-activity.

The weakly mineralized, *sparkling waters*, often called *table waters*, so much in favour at present, are to the majority of persons unnecessary, and when taken at meals are apt in many persons to cause distension of the stomach. They are better borne, and to some persons beneficial, on an empty stomach or between meals. When the ordinary water is pure, it is as good as, for many preferable to, sparkling waters; but when its purity is doubtful, natural sparkling waters form a good substitute, provided they contain only a small proportion of salts, such as Selters, Fachingen, Apollinaris, Rosbach, Johannis, Perrier, St. Galmier, &c. By taking the ordinary water properly filtered, and thoroughly boiled for four to five minutes, the dangers of its impurities are minimized. Filtering alone is mostly unsafe.

It is impossible to lay down strict rules of diet suitable for everbody, as the rule which is good for one is unnecessary and sometimes injurious to another. The old adage, "One man's meat," &c., must always be kept in mind. Articles of food which cause indigestion in one person, or at a certain period of life, or in certain conditions of the health, as for instance, beef, eggs, lobster, strawberries, or mushrooms, are perfectly well borne by another person, or even by the same person under changed conditions. Many people say that the best rule to follow for everyone is to take what agrees with him, and not to trouble himself about other rules; but this "best rule" is not quite as safe as it appears. Lord Bacon expresses this in the essay "Of Regimen of Health:" "A man's own observation, what he finds good of, and what he finds hurt of, is the best physic to preserve health; but it is a safer conclusion to say, 'This agreeth not well with me, therefore I will not continue it,' than this, 'I find no offence of this, therefore I may use it'; for strength of nature in youth passeth over many excesses which are owing a man till his age." The correctness of this remark we witness every day. A man, for instance, may daily take large quantities of meat and alcohol and may feel quite well and fit with it all and think that it agrees with him and that he may take it regularly and in any quantity he likes, while he all the time prepares future trouble for himself, such as disease of the kidneys, arterio-sclerosis, premature senility, and early death. If one intends to lay down rules, one has to study in every person the constitution, the size, height and weight, the age, the degree of activity—mental and bodily— the individual peculiarities and the influence of habit, and to arrange the quality and quantity of food accordingly.

One thing, however, is certain, namely, that the want of moderation is opposed to the prolongation of life, and that this was known already to the ancients is shown by an epigram of Martial quoted quite lately at the Assurance Medical Society [135A] by Dr. Parkes Weber (in a paper on "Diseases in their Relation to Obesity"):

> "Immodicis brevis est ætas et rara senectus."
> —Book VI, 29, 7.

We also can lay down with perfect safety the rule that *great moderation in the amount of food*, and especially of the most nourishing articles, (flesh food, cheese and pulses), ought to be practised by everybody, particularly by elderly people, and that this moderation is a great aid to longevity. But the term "moderation" has a different meaning for different persons and conditions. Moderation to one is excess to another. Many people think that they may eat large quantities of highly nutritious food if they abstain from alcoholic stimulants, but this is a great mistake. In acting on this erroneous view they, or at all events most of them, gradually develop changes in their blood-vessels which do not come to their perception at once, but for all that take place, and later on become manifest as gout, dilatation of the heart, atheroma, arterio-sclerosis, glycosuria, disease of the kidneys, the liver, &c. Professor Baeumler has well explained this in his recent contribution on arterio-sclerosis. An unnecessarily large amount of food, especially flesh food, often, by developing disease of the minute blood-vessels, impedes the flow of blood to the tissues, and causes, in fact, their starvation, while a limited, but sufficient amount, which is often erroneously called "starvation diet," improves and maintains their nutrition. *Superabundance of food leads, in fact, more frequently in the course of time to starvation of tissues than moderation, which helps to maintain them in a healthy condition.*

It has been observed by others as well as myself, that amongst great eaters, especially meat-eaters, there are some sufferers from anæmia (probably from alimentary auto-intoxication), and that this anæmia is increased by continued excess of flesh food. In this respect, some experiments on rats by Dr. Chalmers Watson [131] are interesting. Watson found that the bones of young rats fed entirely on meat became soft, and that the bone-marrow became diseased. As the latter is intimately connected with the formation of blood, the anæmia of some great meat-eaters may possibly be explained by the result of these experiments, but we require further facts on this subject. The scientific basis of our knowledge of nutrition is, at present, but small, our teaching must still be based to a great degree on empiricism. The experience of all those, however, who have occupied themselves thoroughly with this question of food and nutrition, shows that safety lies only in moderation. Sir Michael Foster, for instance, says that "there can be little doubt that the ingestion of food—and perhaps especially of protein food—in excess of what is, under the best conditions, sufficient for maintenance and activity, can only be deleterious to the organism, clogging it with waste products which may at times be of a directly toxic nature." I may refer also to the two cases mentioned on pp. 134 *seq.*, and the remark of Sir Lauder Brunton that the ages reached by old persons maintained in workhouses are often very great. "A workhouse diet," he adds, "may not be very pleasing to the palate, but it certainly seems an efficient means of prolonging life, and it might certainly be worth while sometimes for others to adopt it whose circumstances would allow them to indulge in luxury." I further direct attention to the remarks on "overfeeding" made by Dr. Hutchison in his work on "Food and Dietetics." [62].

Often, indeed, have I noticed in practice that persons eating largely and constantly suffering from various troubles — dyspepsia, headaches, neuralgia, rheumatism, mental depression, irritability, &c., when placed for several months on a reduced diet, got rid of all their ailments; many of them afterwards, when returning to their usual excessive diet, began again to suffer, but recovered almost immediately on diminishing their intake. L. Cornaro [29] already remarked, that whenever he was induced by his friends to take more than his usual small allowance, he began to suffer in various ways, and that all his troubles disappeared when he returned to his very limited diet. In explanation I may refer to Pavlov's experiments on dogs [103], showing that reduction of the amount of food causes increase and better quality of the secretion of the gastric glands.

As a proof of the beneficial influence of great moderation, I may also mention the fact, often-observed, that persons with delicate digestion from an early age onwards, who could take but very small quantities of food, only one-third of what the rest of their family and the majority of people took, and only special kinds of food, such as milk, cream, light puddings, eggs and the smallest quantity of boiled chicken or whiting or sole, without suffering, usually remained free from gout, rheumatism, neuralgia and other complaints, and lived much longer and enjoyed a much healthier old age than the more vigorous companions of their youth, who could and did eat large quantities of food with enjoyment and with *seeming* impunity.

Many years ago I observed on myself that the reduction of the amount of food, especially meat and other flesh food, to half the quantity I had been in the habit of taking, enabled me to do a larger amount of work without the feeling of mental fatigue and exhaustion, and craving for tea or coffee one or two hours after a meat lunch. When afterwards patients complained of fits of yawning, sleepiness, and inability to do good literary work during some hours after a heavy breakfast and lunch, I induced them to substitute light breakfasts and lunches without, or with very little, flesh food, and this was almost constantly followed by the entire disappearance of the inconveniences formerly felt. Undoubtedly, an unnecessarily large intake of food throws extra work on the digestive and metabolic organs of the consumer, and thus necessitates more or less waste of his vital energy. I have also almost invariably observed an improvement in the *complexion* of persons who had exchanged light meals, with little meat, for the heavy meals which they formerly had been accustomed to.

Most persons indulging in a large appetite, whether abstainers from alcohol or not, if you tell them that they must reduce the amount of food, must take only little meat and flesh food and alcoholic stimulants, think that you are going to starve them, that it is impossible for them to do their work on reduced allowances. They are mostly confirmed in this view by their relatives and friends, especially the female part

They ascribe any feeling of lassitude, headache, disinclination to active work, to the diminution of alcohol and meat, and under this impression discontinue carrying out your suggestions. They forget that the same symptoms are mostly caused by too large meals, or by constipation and absorption of toxins. It is quite true that in some people such reductions, when made too suddenly, have unpleasant effects, but only temporarily; and if the reduction is made gradually, the body becomes easily accustomed to it and the mind also. Some of the inconveniences felt are with many persons due merely to the fear of being "lowered." Experience in many hundreds of cases authorizes me to say that more or less gradual reduction, carried out with judgment and perseverance, leads almost always to increase of mental and physical power, greater resistance to disease, cheerfulness, and the prevention of premature old age. The majority of Japanese live in perfect health, and perform a large amount of work on a smaller amount of food than the majority of Europeans would consider sufficient to maintain vigorous life. Few people know how little food is required to maintain health, especially in advanced age. Professor Chittenden's [26] experiments at the Yale University indisputably show that the amount of food required for the maintenance of perfect health and strength is much smaller than had previously been assumed. In Chittenden's experiments the quantity of meat, and all other flesh-food and eggs, was reduced to a small proportion of the entire intake. Amongst the results arrived at by the "Collective Investigation Committee" we find that only few (5 per cent.) of the persons above 80 years had been large eaters of animal food, and that the majority had eaten only little meat (Professor Humphry, [60]), and this result corresponds to my own experience. The late Sir Henry Thompson has given excellent advice in "Diet in Relation to Age and Activity," and not less so the late Dr. George Keith in his "Plea for a Simpler Life" [67]; but their lessons are not acted upon by the majority. As long ago as 1558, L. Cornaro, of Venice, showed by the description of his own manner of living, when he was more than 90, in his "Discourses on a Sober and Temperate Life" [29], how, on a very small amount of food and wine, one can maintain perfect health and happiness, and reach a very advanced age. He lived to over 100, and died without suffering.

During my observations on this subject, extending over more than sixty years, I have been able to inquire into the manner of living and other antecedents of over 100 persons living to between 86 and 102 years. Although most of these persons belonged to the well-to-do classes, and were not obliged to restrict themselves, there were not more than six amongst them who had more or less habitually indulged themselves by eating or drinking largely; many, on the contrary, were remarkable for great moderation in both eating and drinking; some lived almost entirely on vegetables and fruit, with the addition of milk, cheese, butter, and occasionally eggs, and only quite exceptionally took meat, fish and poultry.

Vegetarians,[1] strict as well as modified, can attain long life and can perform the same amount of work as great meat eaters and mixed food eaters; and it is at present less difficult to live entirely on vegetable food than it was in former years, since great progress has been made in the cultivation of vegetable foods and rendering them agreeable to the palate by cooking. We must, however, not lose sight of the fact, that a purely vegetable diet entails great bulkiness of food, which causes in many persons distension of the alimentary tract and weakening of the muscular coat. This is especially the case with sedentary workers, while the labourers in the field and those taking much active exercise, bear it much better, and save by it. When we further consider the general experience that for the great majority of healthy people the admixture of milk, butter, cheese and eggs removes the inconvenience of a strictly vegetable diet, we must regard the latter as inferior to the modified or *lacto-vegetarian* diet. Even the addition of a small quantity of flesh food agrees with the majority better than an exclusively vegetarian diet. It is especially by persons suffering from gout, chronic rheumatism, arterio-sclerosis and diseases of liver and kidneys that flesh food ought to be taken very sparingly or altogether avoided, and that milk, cheese and eggs should be substituted for it. Also smaller complaints, such as headaches, neuralgia, eczema, acne, roughness and scaliness of the skin, and fœtor of breath, often disappear by total abstinence during months and years from flesh and fish. Not.

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[1] The creed of vegetarianism dates back to Porphyry of Tyre and to earlier ages, but Porphyry, who lived in the middle of the third century of our era, wrote a celebrated book concerning *abstinence from animal food*, in order to revive primeval simplicity of diet.

merely this diet leads also, as already mentioned (p. 124), to great improvement of the complexion. Many of these smaller ailments are the sure indications of the tendency to grave disease of the kidneys, the liver, the blood-vessels, and other organs, which, when once fully developed, are often incurable. The old maxim, *Principiis obsta*, must guide us here as in so many other matters. Excessive eating occurs also, though less frequently, amongst vegetarians, especially those who consume large quantities of pulses, and produces injurious effects similar to those caused by excess in meat.

Dr. A. Haig [49 and 50] gives judicious instructions about diet, but the very strict rules laid down by him, entirely excluding meat, tea and coffee, although well suited for some exceptional persons, are certainly *not necessary for all*, not even for the majority. To this question of food, as to so many others, Goethe's words are specially adapted :—

> "Eines schickt sich nicht für Alle !
> Sehe Jeder wie er's treibe."
> "What is fit for A is not fit for B ;
> Let everyone to his own course see."

The same truth is also tersely expressed by the old English adage, "Every man is a law unto himself."

To give only a single instance: persons who are too fat or inclined to corpulency or obesity must avoid sugar almost entirely, while other healthy persons may in moderation indulge in it and benefit by it; they must also restrict themselves in regard to starchy foods, such as potatoes, cornflour, cakes, white bread, while others may almost live on them.

A very strict adherence to stringent rules of diet is not necessary to healthy persons; it may even cause a species of hypochondriasis. A healthy man has arrangements in his body which allow him great latitude in dietetic and hygienic matters, without causing harm. The powers of adaptation and compensation are in strong constitutions very great. What is desirable is the acquisition of a *habit of living* adapted to the individual, which may be acted upon without constantly asking oneself, "Will this do me good or harm?" Even persons with delicate digestion can acquire this habit.

Many persons assert that the teeth and the digestive tract of man point to his requiring a large share of flesh food in his diet. This is by no means in accordance with *fact;* his teeth, jaws and intestines resemble much more those of herbivora than those of carnivora.

They are similar to those of monkeys, which thrive better on vegetable than on flesh diet. It is well known that some monkeys which never have taken any meat possess great strength, for instance, the orang-utang and the gorilla, whose teeth and intestinal organs closely resemble those of man. From this alone we might infer that meat is *not necessary* for strength in the human being, and experiment proves the correctness of this inference; but, as already mentioned, I see no reason to say more than "not necessary."

If we examine the longevity of animals we find some herbivora very long lived, like the elephant and the parrot, others short lived, like the hare and the monkey; some flesh feeders, like the hawk and the eagle, are rather long-lived; others, like the fox, short lived. We can therefore draw no inference from this comparison with man.

Those who maintain that a large quantity of *flesh* food is necessary for average mental and physical vigour, are more wrong than those who forbid it entirely.

Excess of food rich in proteins causes, as Sir W. H. Allchin justly says [5], often lassitude, want of energy, headache, constipation, skin affections and feebleness of the heart.

Quantity of Food.—An important question, which is still under discussion, is the amount of food required by healthy persons. Voit, Playfair, and other physiologists have made elaborate experiments and have stated in figures the amounts necessary, which had been adopted for many years as the standard; but Horace Fletcher [45], Chittenden [26], and others have shown that health and vigour may be maintained by a much smaller quantity. It is generally stated that an average man weighing 11 st. requires daily the following quantities of food (dried):—

3½ oz. of protein (100 grammes),
14½ oz. of carbohydrates (starch and sugar, 400 grammes),
1¾ oz. of fat (50 grammes),

which yield about 2,500 calories; but it is scarcely necessary to say that the amount of food required varies with the amount of energy spent. Thus the same individual when sawing wood requires nearly double the amount of what he requires when doing light work, such as bookbinding, and three times of what he requires lying motionless in bed. For public institutions, prisons, asylums, &c., it is necessary to fix a dietary, but for private persons, we have to take into consideration the great differences which exist between different persons, in height, weight, shape of body, age, constitution, temperament, proportion of muscle to fat and bone, activity, and habit. The influence of activity is quite evident when we consider Atwater and Benedict's statement, that a person sitting without moving in a chair produces 8 per cent. more heat than when lying in bed, and that the heat production is further increased when the sitting in the chair is accompanied by the ordinary movements of the arms. This increased production of heat demands increase of fuel, and this increase must be multiplied if manual labour or other active exercise is performed. The increase of food required is in proportion to the increased loss of heat. We have also to take into account the surroundings, meteorological conditions, humidity of the air, temperature, amount and character of wind, and climate. In a dry, cool and windy (stimulating) climate, much more heat is abstracted from the body than in a humid, warm and windless (relaxing) one; more food is therefore required in the former than in the latter. The seasons, too, influence the quantity and quality of food which are needful; during the cold winters most persons consume, with advantage, more food, especially heat-producing food, than during hot summers, although many weak and anæmic persons form exceptions to this rule.

Although it is impossible to fix the amount of food required by different persons, we may state as a general experience that after a meal a person should not feel heavy and unfit, but should be as fit for mental and physical work as before the meal. This is in accordance with the aphorism by *Sanctorius*, Professor of Physic at Padua and inventor of a weighing chair [113A]: "that is the most healthful proportion of meat, when after eating the body performs whatever it has to do with the same agility as if it were fasting." If he feels after the meal heavy and unfit, the meal was too large or otherwise unsuitable.

I cannot say how little is required, but I venture to record here two cases which, although they are not accurate enough for scientific investigation, give a fair idea of the small quantity of food required for the maintenance of perfect health :—

(1) L. T., aged 61, consulted me first in November, 1872, on account of attacks of gout and hæmorrhoids. His father had died of apoplexy, aged 66; his mother of cancer at 68. He was

himself a powerful man, 6 ft. 1 in. high, weighing 13 st. 5 lb. He was a country gentleman with literary tastes; took much meat and little exercise and slept about ten hours a day. He suffered from frequent attacks of gout, constipation, hæmorrhoids and dyspepsia.

Advice: Daily breathing exercises during fifteen to twenty minutes, daily walks of two or three hours. Less meat, more green vegetables, restriction of alcoholic stimulants to 1 oz. of whisky. Four ounces of Friedrichshall bitter water on rising, three times a week, for two months. To sleep not over seven hours.

In the course of a year the weight diminished by 12 lb., and he was altogether better; but he had had several attacks of gout. He then left off butcher's meat entirely, and alcoholic beverages almost so. In May, 1874, he was further improved; but he was not satisfied with the gain, as he felt often heavy, sleepy, unfit for mental work; and we then settled on the following daily dietary:—

4 oz. fish or poultry,
1 pint milk,
2 oz. butter,
8 oz. brown bread,
6 oz. potatoes,
12 oz. green vegetables,
2 or 3 apples
1 oz. whisky.[1]

On this diet, to which he kept very strictly, and which was enforced by his intelligent local doctor, the attacks of gout disappeared entirely, and he kept perfectly well until 1880, when he became mentally depressed by the death of his only brother from apoplexy (aged 67) and a sister from pneumonia (aged 65.) After travelling for some months he regained his cheerfulness and remained well till the autumn of 1890, when chronic bronchitis developed itself. He could not be induced to go to a warmer climate, and died in December, in his eightieth year. None of his brothers and sisters, nor of his parents' brothers and sisters had lived to the age of 70.

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[1] The whisky was discontinued in August, 1874.

(2) F. W., aged 49, came under my observation in March, 1871. His family history was not good: father had died, aged 65, from "dropsy"; mother, aged 61, likewise from "dropsy." Of his three brothers, two were gouty, one had died from phthisis. F. W. led an active life in the country—fishing, shooting and rowing. He had during the last five years rather frequent attacks of old-fashioned "podagra." He took a large quantity of animal food, and about 1 pint of port or sherry or champagne daily. Height, 5 ft. 5 in.; weight, 11 st. 5 lb.; red face, large stomach—a condition which often is called "abdominal venosity" or "abdominal plethora." The urine contained traces of albumin and large amounts of uric acid and urates, with medium specific gravity. After a course of treatment at Carlsbad the albumin disappeared, the abdomen was reduced in girth, and he felt well; but later on the attacks of gout returned, and in 1874 he consented to the following plan of diet, which his doctor carefully superintended, weighing the

food at intervals. Ration of food for twenty-four hours :—

3 oz. meat, or fish or poultry,
6 oz. potatoes,
16 oz. green vegetables,
16 oz. milk,
6 oz. brown bread,
1 oz. butter,
2 small cups of weak tea.
Half a bottle of Zeltinger (Moselle).

This diet he kept to except during rare intervals, but whenever he took for some weeks a larger quantity he began to feel less well. He carried out regular breathing exercises and had much open-air exercise, besides doing some work in his parish and county, and he became free from gout. His weight decreased to rather below 10 st. After his seventieth year he further diminished the quantity of food and left off wine; he died at the age of 81 in his sleep. Both his brothers had died before they were 67, from "gouty complaints," after protracted illness.

The health of these two men, to which I could add many other examples, we may assume, was much improved and their lives were prolonged by the change of diet from abundance to great moderation. In neither case was the family history good, and both outlived all their near relations by many years. We also see that much less food is required for maintaining health and vigour than is taken by at least nine persons out of ten. It is probable that the food taken by these two men might have been further reduced, if it had been necessary; but as they enjoyed perfect health and strength, there was no reason for trying such an experiment. It is scarcely necessary to add that I do not ascribe the prolongation of life in these cases to the reduction of food alone, but that I attribute also a share in the effect to the breathing and other exercises.

In calculating the nourishing value of different foods, it is not enough to know the quantities of protein, carbohydrates and fat which they contain, but we must consider the quantities of these substances which are digested and absorbed. Thus lentils, peas and beans contain, for equal weights, more of these substances than fresh (not dried) meat, but a large part of the contents of the former passes off with the fæces, while the latter is almost entirely digested, absorbed and utilized in the body. For this reason a smaller amount is required of the latter than of the former.

I am in favour of not restricting the amount of food to the minimum necessary for the maintenance of life, but of allowing a slight margin of excess, if it is well borne, in order to store up a certain amount of reserve in the body for emergencies, such as temporary inability to obtain or take up the necessary amount of food. We may take it for granted that the degree of vitality of the whole body depends on the vitality of the single cells, which is to be maintained by the amount of material supplied to them. This amount, therefore, is not to be stinted, if a high degree of efficiency is to be maintained by an individual, but the quantity of the supply must not be greater than can be thoroughly metabolized. This should be effected by adapting the quantity and kind of food to the amount and nature of work and exercise, in other words, to the physiological requirements.

It is admitted as a general rule that the metabolism is greatest in youth, up to the age of 25, and that the amount of food required is proportionally large, that both decline gradually till the age of 45 to 60, and rather more rapidly after 60; and all authorities are agreed that in *old age* the amount of food ought to be *very limited.* Lord Bacon says in "Regimen of Health": "Discern of the coming on of years, and think not to do the same things still, for age will not be defied." Dr. George Cheyne says in one of his rules: "The aged should lessen the quantity and lower the quality of their food *gradually* as they grow older—even before a manifest decay of appetite forces them to it" [25]. There are, however, in this respect too, great differences in persons of the same age. A man of 80 who takes a comparatively large amount of physical and mental exercise, can and ought to take a larger quantity of food than a man of the same age who does scarcely any physical or mental work. *Activity* allows and requires more food than *inactivity*.

It is astonishing that in spite of the consensus of authorities as to the necessity of restriction of the intake in old age, many old people will continue indulging their appetites, and take more than they can metabolise, and prepare for themselves unnecessary suffering. Much good can be done under such circumstances by the reduction of food. I could give numerous examples, but will confine myself to two:—

Case 1.—A. M., 64, a solicitor, 5 ft. 11 in., 11 st. 5 lb., the youngest of seven children. Father died 71, bronchitis; mother 68, kidney disease. All brothers and sisters had died between 50 and 70. Complained of flatulency, constipation, giddiness, sleepiness, inability to work, frequent catarrhal affections, without signs of organic disease, but looked older than his age. He had a good appetite and indulged it, and took 5 to 6 oz. of whisky. He slept eight to nine hours a day.

Treatment.—To walk 2 to 4 miles a day and gradually more, to take breathing exercises, to diminish the amount of food to 2 or 3 oz. of meat or fish, or poultry, or 2 eggs, 8 oz. of wholemeal bread, 10 oz. of milk, 3 oz. potatoes, 3 oz. green vegetables, 3 to 4 oz. of fruit, apples by preference, twice a day weak tea or coffee, 1 oz. butter, 1 oz. sugar, diminish and gradually discontinue alcohol. Take a tumblerful of hot water night and morning. After a month he was much better and had lost 4 lb. in weight. He continued this manner of living, became bright and active, and died at the age of 79 in consequence of an accident.

Case 2.—S. T., a lady of 68, 5 ft. 6 in., 11 st. 2 lb., rather fat, with a ruddy, good-natured expression; she was the third child of six; both parents had died between 65 and 70, as well as her two elder sisters, while two younger brothers and a younger sister were alive, though not in perfect health. The patient had had severe epistaxis twice during the last year, had often headache, attacks of giddiness, lumbago and piles. She had a good appetite, ate twice a day meat or other fleshy food and took two glasses of sherry. She took scarcely any walking exercise, but drove herself two hours every day in a pony-chaise. She was ordered not to exceed 2 to 3 oz. of meat, fish or poultry and one egg a day, to take 8 oz. of wholemeal bread, 2 oz. potatoes, 4 oz. of green vegetables, 2 or 3 oz. of fruit, ½ oz. of sugar, 1 oz. of butter, 8 to 10 oz. of weak tea or coffee twice a day, no wine, and a tumblerful of hot water night and morning. To walk twice a day half an hour in addition to her drive. On this regimen she improved rapidly, decreased in weight to 8 st., 8 lb., and lived to 83, when she died from whooping cough, caught from a grandchild.

With advancing years the tendency to arteriosclerosis and other degenerations of the small blood-vessels frequently shows itself. One of the prominent signs is increased blood-pressure, to which Sir Clifford Allbutt has recently directed attention [2, 3, 4]. This symptom, combined with others, ought to be a warning that the amount and quality of food must be reduced, sometimes even restricted to milk, milk puddings and vegetables. If the disease is in an advanced state, the benefit can only be limited. *Prevention*, as Sir William Osler said in his lecture on "Angina Pectoris," is the wisest rule, and this is effected by great moderation, especially in flesh food and in stimulants, assisted by a certain amount of physical exercise adapted to the condition of the body. We must bear in mind that the *metabolism* in old age is much diminished, that the mucous membrane of the intestinal tract and the various digestive glands undergo in old age a certain degree of atrophy, and that the cells of the different tissues and organs of the body have a more limited power of assimilating and decomposing nutrient materials (von Noorden, Ebstein, &c.). The metabolism, as already stated, is greatest in childhood, and decreases steadily from about the 10th year. This is shown by the amount of carbonic acid exhaled and the amount of oxygen consumed at different ages. Hence in adult and advancing age the amount of food required for the same weight of body is less than in childhood.

Erroneous ideas are often entertained by the public with regard to the external appearance and the weight of the body. Many old persons are alarmed by their becoming thinner, and, to avoid this, think they must eat more; but this is mostly quite wrong. In the majority of cases any considerable increase of weight after 65 above the average for height is not good, and corpulence where it occurs is to be counteracted by restriction in food, by exercise and other means. A slow decrease in weight is mostly observed in those who reach a very advanced age. Dr. Rabagliati, in an interesting paper read before the Assurance Medical Society in March, 1915, has shown that *overweight* after the middle age is, on the average, not favourable, while *underweight* is favourable [108A]. The old saying, *corpora sicca durant*, remains good to this day.

It is not only the *quality and quantity of food which we take, but also the manner in which it is taken, on which health depends.* Food ought not to be taken when the mind or body is exhausted; rest ought to precede the meal under such conditions; further, if possible, food ought not to be taken while the mind is in a state of anger or violent excitement, or when the act of eating is constantly interrupted by calls of business.

Food ought not to be taken either too *hot* or too *cold*. During cold weather the temperature of food most agreeable is between 95° and 105° F. Food above 115° F. impairs the peptic fluids of the mouth and stomach. Ices and iced drinks ought to be avoided or taken only very sparingly by delicate persons. They are apt to cause gastric catarrh. Cold food, under 55° to 70° F. does not stimulate the gastric functions so much as hot food, and is less easily digested.

All important is *thorough mastication*, a subject constantly preached, but almost as constantly neglected. Many forms of indigestion and of serious disease of the stomach and intestines, many states of imperfect nutrition of the whole body, are caused by imperfect mastication, by *gobbling* and *bolting the food.* Quite lately Dr. Harry Campbell [21], Dr. van Someren, of Venice, Mr. Horace Fletcher [45], and others, have again directed attention to this matter in a judicious and forcible manner. Gladstone attributed much of his health and long life to his habit of thorough mastication. It is especially food containing much starch, such as potatoes, bread, biscuits, toast, &c., which require long and thorough mastication, while flesh-foods need only be perfectly comminuted in the mouth. Sir Lauder Brunton justly points out the possibility that imperfect mastication may be a cause of cancer of the stomach through the irritation of the mucous membrane by hard particles of insufficiently masticated food. Combined with the fault of bolting is often that of *washing down* the food before it is properly masticated, a grave mistake committed frequently by hard-working men, by large eaters and by those who take much fluid during the meals, which in itself, as remarked before, is an injurious habit. No food ought to be swallowed before it has been tranformed by mastication and admixture of saliva into a semi-fluid substance. Even fluid or half-fluid food, such as porridge, gruel, soups, coffee, tea and chocolate, ought not to be gulped down rapidly, but ought to be taken slowly. One must always bear in mind that the process of digestion does not commence in the stomach but in the mouth.

Amongst the great benefits of thorough mastication is the diminution of the formation of gas in the stomach and intestines (flatulency), and, further, the prevention or limitation of putrid fermentation of the food in the intestines.

Another effect of mastication is that less food is required, because more of the quantity taken in is digested and absorbed, and for the same reason the bulk of fæcal matter is diminished, and the evacuations may become less in bulk and frequency without some of the disadvantages of retention.

An accessory advantage of mastication is the proper development of the jaws, and the teeth. Our primitive ancestors evidently, from the nature of the food, were obliged to masticate more thoroughly than we do ; hence the large size of their jaws.

As proper mastication is one of the most powerful means of maintaining health, it is selfevident that the organs of mastication, *especially the teeth*, ought to be carefully attended to, from early life to old age. Children ought to be taught to brush their teeth after meals, and before going to bed, in order to remove the remaining particles of food, which undergo acid fermentation and by fostering numerous bacteria tend to promote decay of the teeth. We must leave this subject to dentists, but we must insist on the importance of instruction on the management of the teeth in children as well as adults, on the regular examination and treatment of the teeth of school children, and the use of good artificial teeth after the loss of the natural teeth wherever they can be afforded. This, we hope, will be facilitated by the manufacture of cheaper artificial teeth.

A weighty matter which is often overlooked in rules about diet is the *condition of food*, viz., that it is clean and fresh, not approaching mustiness or putresence, not contaminated with organic or inorganic noxious substances. Part of this ought to be secured by the public inspector, but even when bought in a wholesome condition, articles of food are often damaged in the house by exposure to dust, to flies, to microbes in the air; or are allowed to become stale and putrescent before they are consumed. The storage of the food is a most important matter. It is impossible to bestow too much attention on these points. Some of the dangers to the body are avoided by cooking, but not all.

It would be out of place to enter adequately into the subject of *cooking the food*, although its great importance was already recognized by Hippocrates, who said, that we must not only know what qualities every sort of food is endowed with from Nature, but also what new qualities it receives from art in the various ways of dressing it. I restrict myself to a few words. Some kinds of food become by cooking more, others less, digestible ; some gain, some lose in nutritive value, The amylaceous vegetables, such as potatoes, rice, maize and cereals, gain in digestibility by cooking and baking, since thereby the cellulose, in which the starch granules are enclosed, is burst, and the starch thus becomes directly exposed to the action of the digestive ferment. All the vegetables rich in cellulose are rendered more digestible by the process of cooking. Many, however, lose some of their salts and soluble substances, which pass into the water in which they are boiled. Stewing, or steaming, is, where fore, preferable to ordinary boiling, whenever it is desirable to retain all the constituents of the vegetables. Most flesh-foods, on the other hand, are somewhat impaired in their nourishing value by cooking, as the boiling heat coagulates the proteins, renders the fibres of meat harder and rather less digestible. As, however, most people feel great repugnance towards raw flesh, and as, besides, raw meat contains sometimes injurious parasites, we must endeavour to use methods of cooking by which the taste and appearance of rawness and the danger of parasites are removed, while the fibres retain their tenderness and the flavour is not destroyed. This is attained by exposing meat and poultry only for a few minutes to a temperature of 100° C. (212° F.) or more, and thus produce a kind of crust which prevents the loss of juice from the interior. When the crust has been formed, the cooking process is to be continued at a lower temperature—not exceeding 180° F.—for a longer period. By this process we obtain tenderness and preservation of the natural flavour. One of the aims of cooking ought to be to render the food as appetizing as possible. The advantage of the palatability of food is not restricted to the gratification of the sense of taste. By increasing the secretion of saliva and gastric juices, it helps the formation of secretin (Bailiss and Starling), and through this the action of the pancreas. Thus from the same article of food the body may obtain more nutritive material if it is taken in an appetizing than in a non-palatable condition. This object can be obtained by *roasting* as well as *boiling*. Another advantageous way of cooking meat is *stewing*, if properly done, with avoidance of heat above 180° F. The fibres become tender, and the juices; the flavour and the salts are retained.

One of the beneficent influences of cooking is the destruction of pathogenic microbes, such as the bacillus of tuberculosis, of typhoid fever, cholera, diphtheria, and scarlet fever in milk and water ; though it cannot be denied that also friendly bacilli are destroyed by cooking. In addition to bacteria the danger of infection with larger parasites, such as trichinæ and tape-worms, can be avoided by the process of cooking. On the other side, as already mentioned, long exposure to the boiling point seems to injure the action of the vitamines, as for instance in milk (p. 89).

Sick and delicate persons with poor appetites and convalescents from acute diseases ought to be indulged with articles of food which they like and which are cooked according to their taste as far as the condition of their digestive organs allows. It is further important to provide a certain degree of *variety* of food, for constant sameness lessens in most persons the appetite, causes even actual dislike, and impairs digestion.

In urging the necessity of careful preparation and palatableness of food for delicate persons, we must, however, not fall into the other extreme, namely, that of sacrificing the digestibility to the pleasure of the palate.

For most persons, excepting the strongest, it is desirable that they should avoid exertion of mind and body just before, during, and soon after, the principal meals, so that the stomach receives as well the blood as the nerve power necessary for the digestive processes.

It is often said that persons doing a large amount of brain work require a great quantity of food and stimulants ; but careful observation does not prove this to be the case. I have known many hard brain-workers who did their work best when they ate and drank quite moderately. Dr. Keith, in his "Plea for a Simpler Life" [67], mentions that Sir Isaac Newton, Napoleon, and Wellington took scarcely any food while they were engaged in great problems. Several of my own friends, occupied during long periods in arduous literary work, took while thus engaged much less food than at periods of leisure, since they had found that they worked much better with little than with much food.

The proportion of the different kinds of food ought to be arranged according to the peculiarities of the body. Persons with a large mass of muscle have a greater waste of nitrogenous matter than persons with small muscles; the former require a larger proportion of proteins than the latter.

The distribution of the food consumed during twenty-four hours can be varied considerably according to constitution, state of health, occupation, social custom and personal habits. A few strong persons can take all their food at one meal, others require only two, but the majority feel best with three, and some do not feel well with less than five; the latter is especially the case during convalescence from acute disease and in neurasthenics, weakly and aged subjects. Too many meals interfere in most persons with the secretion of the digestive juices. For the majority of persons it is best to take the two principal meals without or with very little fluid, and to take the fluid required an hour before or after meals, or only night and morning. In whatever manner the food is distributed over the day, it is essential that *sufficient time* is allowed for each meal, so that mastication can be thoroughly performed, and that the principal meal is placed at the period of the day when the mind and body can be kept quiet, for

> "Unquiet meals make ill digestions"
> ("Comedy of Errors," Act. v, Sc. 1),

and when hard work—mental and physical—can be avoided for some time after the meal. Food ought not to be taken when persons are in a state of anger, or fury, or great fear, as already stated. Some authors maintain that there ought to be no regular hours for meals, but that food ought only to be taken when there is a feeling of hunger. This may be satisfactory for some independent people who live alone or need only think of themselves, but those occupied in offices or factories; in the Navy or Army, or in schools, or who live in families, must take their meals according to convenience, and at more or less fixed times.

Finally, we must warn once more against over-anxiety concerning the quantity and quality of food. Many persons do themselves harm by continually fearing to violate the rigid rules of living which they themselves or others have imposed on them.

VIII.—ALCOHOL.

On the much-debated and all-important question of *alcohol*, I will try to be as short as possible. It cannot be denied that alcoholic beverages cause to many people transitory enjoyment, by their taste, and by their exhilarating effects, and by their diminishing the sense of worry and of physical and mental pain, but it is nevertheless true, as Sir Frederick Treves [126] says, that alcohol is a poison excepting when taken in the smallest quantities. There can be no doubt that, with some exceptions, total abstinence from alcoholic beverages, including so-called medicated wines, would greatly promote the moral and physical health of the human race. *Alcohol is not necessary* to healthy persons, and most of them are better without it. Many diseases of the liver, the kidneys, the brain, the heart and blood-vessels are, no doubt, produced by the abuse of alcohol; many promising lives are destroyed by it; it weakens self-control, and through this is the most frequent cause of *crime* and of the ruin, not only of the drinkers themselves; but of their families and their progeny. The late Lord Alverstone told me that in his experience nine out of ten cases of crime were directly or indirectly due to alcohol. Owing to the impairment of self-control alcohol is also a frequent cause of inchastity, and through this of venereal diseases and all their terrible effects, often not confined to the transgressor alone. Abuse of alcohol is, as Lord Brougham said, "the mother of want and the nurse of crime." Alcoholism is the greatest of all preventable evils affecting the public health. A large percentage of epileptics, imbeciles, idiots, criminals, persons suffering from weak and early loss of memory and other mental deficiencies, melancholia, &c., is due to intemperate habits. The mind is perverted by intemperance, the love of home and family and the sense of veracity and morality are destroyed. The bactericidal influence of the blood is weakened by alcohol and through this the resisting power of the body is lowered towards disease. Alcoholists are not only more prone to take infectious diseases, but owing to degeneration of the heart and small blood-vessels they much more frequently succumb to them than abstainers do. The early mortality amongst those occupied with the production and sale of alcoholic liquors is so well-known that insurance offices either decline their lives, or take them only at very high premiums. The records of insurance offices further show that the lives of total abstainers are longer than those of non-abstainers, including moderate drinkers (Sir Thos. P. Whittaker). The tendency to dipsomania, to alcoholism in general, and to all its painful effects on mind and body is distinctly inheritable, and the descendants of inebriate parents ought, therefore, entirely to abstain from alcoholic stimulants. I am no legislator, but it is to me perfectly clear that the State ought to control the entire liquor traffic and that the opportunities of procuring alcoholic drinks ought to be greatly restricted. It is asserted that alcohol assists the digestion; but this is the case only exceptionally, and when taken in a small quantity with meals.

Alcohol is also regarded by some men of science as a valuable article of food, as an economizer of albuminous substances, but in truth it possesses this virtue only in the smallest degree and it injures the metabolic power of the cells. Alcohol has further been praised as a producer of warmth; but its warming effect is only transitory and is followed by the opposite, even by death, especially on long, cold journeys. Arctic explorers have found that when entirely abstaining they can stand the cold much better than when they do not abstain. The warming effect due to the combustion of alcohol is much outbalanced by the cooling effect produced by the dilation of the peripheral capillaries and the escape of heat through them.

The belief that alcohol increases the body heat, the courage and fighting power of soldiers, has led, in some armies, to the addition of a certain quantity of rum or other alcoholic stimulants to their rations. This is a grave mistake, and, as a rule, the use of alcohol ought to be restricted to exceptional cases only. The removal of vodka from the Russian Army and of absinthe from the French, is a truly wise measure.

The regular use of alcoholic stimulants by *children* and *young persons* is especially dangerous, and ought to be combated at school as well as at home, since it stunts complete development and leads often to the habit of taking in adult life more than is conducive to happiness and to health of mind and body.

Alcohol, like other poisons, can be used as a *medicine* temporarily in various states of exhaustion; it is a heart-stimulant. On this point I cannot fully enter at present, but I must state that it has been greatly abused in the last century, and that even now it is often too indiscriminately and too loosely recommended. Above all things the exact quantity ought to be mentioned by the medical adviser, the times when it is to be taken, and how long it is to be continued, since otherwise the inclination to take too much and to continue it for many months and years may be fostered and the habit of drinking to excess may be and often is created. At the end of exhausting diseases, such as severe enteric fever, pneumonia, influenza, bronchitis, &c., when the nutrition of the heart has been much impaired, the pulse has become very rapid and weak, small doses of alcoholic stimulants frequently repeated are sometimes most beneficial and even necessary, but such cases form the exception, not the rule; and the allowance of alcoholic stimulants must be withdrawn as soon as the necessity ceases. The arrangement which was common and which exists still in some hospitals, convalescent homes and sanatoria, to give a certain amount of alcoholic stimulants as part of the daily diet, is highly reprehensible, and the use of alcohol in such institutions ought to be restricted to those for whom it is considered necessary by the doctor.

The habit of taking between meals "*nips*" and "*pick-me-ups*" in the shape of small quantities of wine or liqueurs, or Cognac, or other alcoholic stimulants, is very injurious, and ought to be counteracted in every possible way. It often leads to *secret drinking*.

Many persons judge the influence of alcoholic stimulants on the constitution merely by the amount of alcohol which they contain. This is not correct. The other constituents of these beverages ought likewise to be taken into consideration. The fermentation of the malt and sugar by which the alcohol is produced is combined with the production of other substances. The so-called "*spirits*," of which brandy, whisky and gin are the ordinary types, most nearly approach in their influence on the body that of pure diluted alcohol; but they also contain various by-products of fermentation, which produce special effects. They are almost free from acidity and are through this more easily borne by some persons than wines; but it is important that they should be well seasoned, and recommended only with the safeguards previously mentioned. The different kinds of *wine* contain, in addition to alcohol, varying quantities of sugar, vegetable acids, ethers, essential oils, extractives, mineral matters, carbonic acid, &c., which modify their effects on the organism. It is impossible to enter adequately on this large subject. Alcoholic fluids which contain a considerable amount of sugar, dextrin, hop extract, albuminous matter, salts, vegetable acids, and free carbonic acid and other substances, such as the different kinds of *beer*, have not the same effects on the digestive organs, the nervous system and the organs of circulation as fluids which are more or less pure, diluted solutions of alcohol, such as those mentioned above. *Beer* owing partly to the purin bodies which it contains (Walker-Hall [130]) disposes many persons who take it regularly to rheumatic and gouty complaints, and by the sugar substances to obesity and the disadvantages and dangers attending it. The difference in the composition of different kinds of beer and in their action on the body is considerable. Professor Baeumler [9] further directs attention to the fact that persons consuming large quantities of beer mechanically overtax their blood-vessels by keeping them in a state of distension, which gradually leads to disease of the small arteries and of the heart, the demands on which become more and more increased by the morbid state of the blood-vessels. My own experience amply corroborates Baeumler's view. Between 1850 and 1870 many young Germans engaged in the sugar-baking trade in the East End of London, came to the German Hospital suffering from various diseases, due partly to the excessive heat to which they were exposed from morning till night, partly and more commonly to the almost incredible amount of small beer (eight to twelve gallons per day) which they took to quench their thirst; dilatation of the heart and hydræmia very frequently occurred, and in one man, scarcely 30 years of age, extensive atheroma of arteries, especially those of the brain.

Small quantities of beer, however, not exceeding a pint in the twenty-four hours, are well borne by many persons who take much exercise, and are less injurious than whisky or brandy exceeding two to three ounces in the day; but the experience of careful and unprejudiced observers show that most persons are better without them.

Sometimes we succeed in breaking off the alcoholic habit by substituting for the usual alcoholic stimulants, non-alcoholic beverages, such as lemonade, ginger-beer, soda-water, effervescing mineral waters, non-alcoholic grape juice, other fruit juices, and fruit syrups with water. The rough, thoroughly fermented cider, too, though not quite free from alcohol, may be taken by many persons in limited quantities, without harm, and even with advantage, by some affected with gout or uric acid tendency. The sweet, bottled, sparkling cider, on the other hand, is decidedly injurious.

In some men I have been able to diminish the craving for alcoholic stimulants by greatly reducing flesh foods, especially salt foods and salt itself; in others by greater moderation in smoking; again in others by inducing them to take no fluid at all at meals, but to wait till an hour after meals, when they were less inclined to drink, and oftentimes forgot it.

A very prevalent idea with regard to alcohol, is that it is more useful to persons in advanced than in middle age, in fact, that "wine is the milk of old people," that it does for them what milk does for children. This doctrine is not in harmony with careful observation, and alcohol, excepting in great moderation, is even more dangerous to the aged than to the younger people. "It seems to me," said Dr. Parkes, "that there must be danger in the use of alcohol, when the arteries became rigid, in advanced life" [102, p. 295].

Alcohol habitually taken in any large quantity injures, in most persons, the arteries and capillaries, the brain cells and nerve-fibres. It is generally admitted that alcohol interferes with the cell-growth, especially in the liver, and partly through this, deteriorates the metabolism and the transformation of the purin bodies into urea. It diminishes the resisting power of the organisms towards chills, microbes and other causes of disease. We hear often that alcohol is not injurious if taken only in *moderation*, but it is the interpretation of this term which is fraught with so much danger. Many persons consider themselves moderate if they never become drunk; some take five or six glasses of sherry or port in the twenty-four hours, or three or more pints of beer, or three or four glasses of brandy or whisky or gin, and declare themselves perfectly moderate. This is a very dangerous kind of moderation to the majority of people. An occasional, but rare, inebriation with intermediate abstaining is much less injurious than the regular use of the amount of stimulants just mentioned. Most persons who take more alcohol than is compatible with their health do not feel any disadvantage from it for months and even years, and often not till actual changes in the heart and blood-vessels, or in the nervous system, have been produced. *The slow and insidious manner in which the regular drinking of so-called moderate, but in reality immoderate, quantities acts, is one of the causes of the frequency and danger of this error.* The fourth part of the quantity mentioned above is what I could call moderation, permissible to the majority of healthy persons. It is a common fallacy to think that alcohol by its action on the brain enables the mind to work more quickly, and the body to undergo greater fatigue. Sir Victor Horsley [58], Professor Sims Woodhead [146A], and others have shown that there is no foundation whatever for this view, and refer to Professor Kraepelin's scientific experiments, proving that alcohol even in small quantities interferes with the highest functions of the brain; that in large quantities it abrogates the controlling power of the brain and cerebellum. A great piano-player, an intimate friend of mine, tells me that a single glass of port wine spoils his playing; and a much admired violinist says the same. O'Shea and Kellogg [97A] state on the authority of Dr. Hodge that "in setting type, adding figures, learning by rote, or doing any fine mechanical work, the man under the influence of even small doses of alcohol does his work less well. The increased activity of the mental faculties which is produced in some persons by alcohol is only of very short duration, and is rapidly followed by impaired and deranged action. Another fallacy is that alcohol enables man to undertake a larger amount of physical work. I have often asked a number of men engaged in physical labour, and from an overwhelming majority of intelligent labourers I have received the answer that they can do more and better work without than with alcohol. My fencing master often said that he perceived the intended movements of his antagonist much more quickly and reacted against them more rapidly when altogether without than after even a small amount of alcohol. A famous pugilist assured me that he never took any alcohol when he intended to fight, and several great wrestlers spoke in the same way. Also the great majority of Alpine climbers find, that alcoholic stimulants impair their power and endanger their safety.

Alcohol exercises on some persons a much more injurious effect than on others. It is in many the cause of epilepsy, and greatly aggravates the disease when it already exists; it ought to be entirely abstained from by persons affected with, or hereditarily disposed to this disease. The same is the case with periodic dipsomania. Persons under the influence of worry, or unsuccessful work, often endeavour to remove their depression by alcoholic stimulants; they frequently succeed for the moment, but fall soon after into deeper despair. Stimulants ought never to be resorted to under such circumstances; temporary cessation from work, or change of scene, if they are possible, and especially open-air games and other open-air exercise, are infinitely more promising.

Persons with small amounts of albumin in the urine, combined with signs of arteriosclerosis, can mostly prolong their life and usefulness for many years by abstaining entirely from alcohol, and greatly restricting flesh foods. Many of them, however, are disinclined to do so, and gladly accept another opinion, recommending not abstinence in alcoholic stimulants and flesh food, but only moderation, which they interpret according to their own liking; they feel secure, but mostly die within two or three years.

Such feeling of "security" always reminds me of the words of Hecate in "Macbeth," which are so often applicable in life:—

> "And you all know, security
> Is mortal's chiefest enemy."—
> *Macbeth*, Act iii, Sc. 5.

Sir Isambard Owen has given a careful analysis of the results of the Collective Investigation Returns, comprising 4,284 persons, and shows that the average duration of life was greatest in the total abstainers and very moderate drinkers, and that only few hard drinkers were amongst the long-lived (*British Medical Journal*, June 23, 1888, p. 1312).

The necessity of the greatest moderation in alcoholic beverages ought to be taught in schools.

Before leaving the subject of alcohol, it may be useful again to allude to an erroneous idea entertained by many persons when giving up the use of alcohol, namely, that they may eat as much as they like, and may drink at meals as much common water or "table waters" as they desire. This misconception is, as I have already said, fraught with great danger, leading, as it does, in many cases to obesity, to weakness of the heart, to degeneration of the blood-vessels (arterio-sclerosis) of the liver and kidneys, to gout, and in all to premature death; the effect is much more injurious than the limited use of alcohol at otherwise moderate meals.

IX.—TEA, COFFEE, COCOA.

The principal constituents of the *tea* leaves are thein, tannic acid, albumin, cellulose and some volatile oil. Tea is regarded by the majority of people as an agreeable and useful stimulant. It is not followed by depression, as alcohol is, and when it is taken in moderate quantity it exercises a pleasant effect on the nervous system, especially in mental or physical fatigue, and is not injurious to the majority of persons; though in some, particularly amongst those affected with dyspepsia and heart weakness, it produces development of gas and through this distension of the stomach and disturbance of the heart and the nervous system. The habit of taking three to five meals of strong tea, and this often not infused but boiled, with inadequate food, is no doubt injurious; it causes deterioration of the digestive organs, imperfect nutrition of the heart and blood-vessels, and lowers the nervous system. The change which many people, especially amongst the labouring classes, have made since the middle of last century, in substituting tea and bread or potatoes for porridge, milk and cheese must be strongly condemned. I have repeatedly seen alarming symptoms in the functions of the nervous system and the heart amongst children, produced entirely by the regular use of strong tea, symptoms which disappeared in the course of a few weeks after the substitution of milk foods for tea meals. The fact that strong tea retards digestion, and that the tannic acid in the tea produces an insoluble combination with protein, renders the habit of taking it as part of the principal meals (*high teas*) to some people rather injurious. When, however, great authorities condemn tea entirely as a poison, even when moderately used, and class it together with the eating of large quantities of meat or the immoderate drinking of alcoholic stimulants as a most potent producer of gout, diseases of the heart and blood-vessels, and of the nervous system, we are not prepared to accept their view. It is true that the tea leaves contain a certain amount of purin (methyl-purin), but if the quantity of tea consumed during twenty-four hours does not exceed the infusion of 40 to 80 grains, it cannot be regarded as a serious danger, unless to a very small number of exceptional persons. We have not seen much real gout amongst great tea drinkers if they were at the same time moderate with regard to meat and alcohol. Black teas agree with most persons better than green teas, and good qualities or Chinese teas, which contain rather less tannic acid, better than Indian and Ceylon teas in the same quantity; but if the latter are taken in smaller quantities than the Chinese, or mixed with them in the proportion of one part of Indian to two of Chinese, no objection need be raised against them. Tea ought not to be boiled but infused with rather soft only just boiling water, and the infusion ought not to stand longer than two to four or five minutes. A teaspoonful (about 40 to 60 grains) of tea leaves is quite sufficient for a breakfast cupful of tea, and half the strength is better for most persons. Although some great tea drinkers object to the addition of milk and cream, most people bear it better with than without. The habit of taking a cup of very weak tea with milk an hour and a half to two hours before breakfast is beneficial to persons who rise early and do some work before breakfast, but the tea ought to be weak. Taken in this way it sustains mental activity, assists defæcation, and aids the removal of waste products; but a tumblerful of hot water is to many persons equally useful. Those who condemn tea do not seem to consider that many persons who take tea as a stimulant save themselves through this from the abuse of alcoholic stimulants, which is infinitely more injurious than tea. Finally, we must not forget that the abuse of alcohol deranges the moral condition of the mind and is the most frequent cause of crime. No one can say this of tea drinking, by which at all events, even if taken injudiciously, only the tea-drinker himself is injured and not his innocent family.

Coffee contains, in addition to caffein, the effects of which resemble those of thein, a volatile oil developed by the process of roasting, some tannic acid, cellulose and extractive material (Parkes [102], Koenig [68] and Hutchison [62]). The infusion acts on most people in the same way as tea, but in some cases it causes palpitation of the heart, indigestion and tendency to piles when they take it habitually, while they can take tea without harm. Many, on the other hand, of those in whom tea produces flatulence and faintness, bear coffee quite well. Coffee has likewise an injurious effect on stomach digestion, and strong black coffee after meals ought therefore to be avoided by dyspeptics with slow digestion. Parkes had a high opinion of the value of coffee for soldiers undergoing fatigue, and in severe Alpine climbing I have found coffee, on others as well as myself, rather more effective than tea, although the latter is likewise very useful. This effect is due principally to the *caffein* and partly to the *volatile oil* which both stimulate the brain as well as the heart. The relief of fatigue and exhaustion which is produced by coffee and tea is, however, due, to some degree at all events, to the vehicle in which they are taken, viz., water with or without milk; for caffein taken alone in doses of several grains by my companions and myself in long mountain tours had never as strong an effect on us as a cup of tea or coffee, especially when taken hot. It is the fluid part which has the greatest share in clearing the tissues from the *waste* products, and this is a matter of the greatest importance. *Chicory*, which is often mixed with coffee, contains scarcely any tannic acid, no caffein and volatile oil, but a fair amount of sugar. It is decidedly less stimulant and is justly regarded as an adulteration.

The various *imitation coffees* made from roasted cereals, acorns, carrots, &c., instead of the coffee bean, are not unwholesome, but have not the taste of real coffee, nor the stimulating effect to those undergoing mental or physical work.

Kola had more effect on us when climbing than caffein alone, but not so much as hot coffee or tea.

This property of enabling persons to bear extra mental and physical exertion which tea shares with coffee, leads occasionally into danger. We have repeatedly observed that under their influence mental over-exertion was persisted in for weeks and months, until it led to exhaustion of the nervous system, which sometimes lasted through life. Working for scholarships, for instance, and for competitive examinations, has in this way caused some sad failures in life. In regard to these objections to the use of tea and coffee we may here also say that safety lies in moderation.

Cocoa is different in composition and action from either tea or coffee, although the alkaloi theobromin is chemically almost identical with thein and caffein. It is decidedly less stimulant. The beans contain a large proportion of fat, in addition to theobromin, starch, albuminous substance, cellulose, some astringent and mineral matter. The cocoa prepared from cocoa nibs and shells is better borne by most persons, though less nutritious, than that prepared from the finely powdered kernel, which disagrees with some on account of the large amount of fat. The ordinary *chocolate* is mostly mixed with starch and sugar. Cocoa and especially chocolate are much more articles of food than tea and coffee, and have great sustaining power in fatiguing climbs and other exertions, but are inferior to coffee and tea in the stimulating quality. To many persons the use of cocoa is preferable to that of strong tea and coffee, especially if prepared from the nibs. If cocoa is taken with much milk, it becomes a real meal. An instructive chapter on tea, coffee and cocoa is contributed to the "Book of Health," by Sir Lauder Brunton, whose views are also given in his "Disorders of Assimilation and Digestion" [16].

We are often asked whether to give the preference to tea or coffee or cocoa in daily use.

It is as impossible to give a general answer, as it is with ordinary articles of food. The personal element must mostly guide us. Where tea produces flatulence, and disorders of the action of the heart, or trembling, or sleeplessness, it must either be greatly restricted or avoided entirely, especially after midday, and coffee or cocoa (or milk) may be substituted, whichever agrees best. Many persons bear all three substances equally well, and can suit their taste or convenience. The rule of moderation applies to these food accessories as much as to the ordinary articles of food; neither of the three is indispensable for life.

X.—TOBACCO.

Tobacco contains nicotine, a strong poison, but is to many persons a means of enjoyment and is well borne by them if they take it with great moderation; it soothes nervous irritability, and often makes men look more contentedly on their work and troubles. Some persons acquire an unlimited tolerance of tobacco, but to the majority excessive smoking is decidedly injurious, by affecting the heart, the small blood-vessels, the digestion, the throat, the nervous system and the sight. In many cases diminution of the amount of smoking, or taking a milder kind of tobacco, remedies the bad effects; in some, however, the use of tobacco has to be given up entirely. Boys and girls, before they are grown up, ought not to be permitted to smoke, as it prevents perfect development. There are good observers, amongst them Professor Lazarus, of Berlin, who regard excessive smoking as one of the principal causes of arterio-sclerosis, and when we consider the effect of tobacco on the heart in some people, it appears natural that the smaller blood-vessels are likewise injuriously influenced by it. Sir Lauder Brunton states that Boveri and Rickett produced atheroma in animals by intravascular injections of nicotine. In this connection I may refer also to a paper by Dr. Michels and Dr. Parkes Weber "On Arteritis Obliterans" [83 and 134]. The patients were Russian and Roumanian Jews, between 30 and 40 years of age, who were free from other morbid complications, but had in common: (1) that they smoked every day many cigarettes; (2) that their food was poor in quality, and probably insufficient in quantity; and (3) that they consumed a large quantity of strong tea. It is to the immoderate smoking that I am inclined to attribute the disease of the arteries, and I may add that tea can probably be excluded, as Professor Israel, of Berlin, has communicated other cases of this disease occurring in Eastern Jews in the prime of life, who lived in Eastern Europe, where tea-drinking is not the custom amongst the poorer classes. The habit of excessive *cigarette* smoking appears to be specially injurious.

Snuff is out of fashion at present; but to some people suffering from chronic nasal catarrh with frequent stuffing up of the nose, a pinch, taken once or twice a day, is useful by increasing the discharge and facilitating breathing through the nose, and also by maintaining to a certain degree the sense of smell up to old age; it seems to act by its stimulation as a species of gymnastics on the capillaries of the Schneiderian membrane. Many doctors in former times maintained that snuff-taking was a good practice against some forms of frontal headache and blear eyes, and I think with good reason.

XI.—ACTION OF THE BOWELS.

An important matter with regard to the digestive system and the health of the whole organism is the *action of the bowels*. There are great differences in this respect in different persons; many only feel well if they have one or two evacuations daily, and even more, and have them without being obliged to pay any attention to the nature of their food; others have a motion only every second and even third or fourth day. Although some of the latter seem to be perfectly well, the health of the majority of them suffers in course of time, especially by interference with the portal circulation and its consequences, and by the absorption of ptomaines, leading to headaches, drowsiness, lassitude, imperfect mental work, some forms of neurasthenia and anæmia. *Constipation* is, besides, a frequent cause of colitis, of piles, and dilatation of the intestines. Furthermore, the irritation which the hard fæcal matters exercise on the mucous membrane of the colon and rectum leads, in some persons, to cancer. It is, therefore, specially to be avoided in old persons, since in them the tendency to malignant disease is greater than in youth. A main point is to accustom the bowels to a regular action at a certain time of the day, a habit which ought to be cultivated from childhood; the morning, if possible, excepting in persons affected with piles, to whom the evacuation of the bowels at bedtime is more useful, since by rest in the recumbent position after the motion the hæmorrhoidal vessels become relieved. An attempt ought to be made to obtain an evacuation at a fixed hour, even if no desire is felt. The neglect of this is a common cause of habitual constipation. Some distinguished doctors think that calls for defæcation at intermediate times ought to be resisted in order to maintain the regularity. Such resistance, however, favours absorption of the products of decomposition and leads in many persons to the troubles mentioned above (p. 178); it besides causes, by degrees, dilatation and atony of the lower bowel. The attempt at the fixed time must be maintained, but if there are intermediate calls they ought to be satisfied, if possible. The quantity and quality of food are of great importance. A diet consisting principally of flesh-food, eggs, cheese and farinaceous matter, is in many persons attended with constipation, while the diminution of these substances and the substitution of fruit and green vegetables lead to regularity and improved health. The principal reason is that of flesh-food, cheese and eggs, the greatest part is absorbed in the upper portion of the intestines, and only a small quantity remains for the formation of fæces, insufficient to stimulate the peristaltic action of the bowel; while green vegetables and fruit having a large proportion of cellulose, which usually is not absorbed in the intestines, yield a larger quantity of fæcal matter, sufficient to promote peristalsis and more rapid as well as more regular evacuations. Dr. Saundby [114] recommends the regular use of sour milk, prepared with "lactobacilline" tablets, about a pint per day. With many people, however, this change of diet alone is insufficient to make the bowels act regularly. They require, in addition to green vegetables and fruit, substances which cause a greater amount of local mechanical stimulation, such as is produced by the bran of brown or whole-meal bread and biscuits. Sir Lauder Brunton explained this in a practical lecture on constipation some years ago. It is possible that part of the aperient effect of whole meal or wheaten bread and biscuit is due to the cathartic effects of wheat oil contained in the outer layers of the wheat kernel (H. Snyder [121]). The best qualities of Smyrna figs are likewise useful, partly no doubt due to the seeds, but partly also to the other portion of the fruit. The addition of honey to breakfast promotes in many persons regularity of the bowels, but it disagrees with some (p. 109). One or two fair-sized raw apples at breakfast and lunch, or some uncooked French plums, are of great assistance to many people, while others prefer them at bed time. Cooked fruit is less active, although it is likewise useful; the cooking seems to destroy or weaken an enzyme. Habitual constipation is usually ascribed to want of tone, or a torpid condition of the muscular coats of the intestines, but this is not the only cause in all constipated persons; in many of them the mucous membrane seems to be at fault either by insufficient secretion (Dr. Rolleston) or by over-active absorption. Professor Schmidt [118] and Dr. Neville Wood [145] have explained the occurrence of constipation in many persons by the peculiarity of their digesting a portion of the cellulose contained in the food, and thus leaving a too scanty amount for defæcation. To prevent this they recommend such persons to take once or twice a day a substance which is not absorbable by the intestines, and forms a coating round the food on its passage through the bowels, thus preventing the absorption of the cellulose and rendering, at the same time, the fæcal matter softer. Such lubricating substances are fluid purified paraffin and agar-agar. They are to most people harmless and efficient if the quantity is well adapted. Dr. Leonard Williams suggests that paraffin oil "probably prevents the large intestine from absorbing undesirable matters by blocking the mouths of the glands; and by dissolving and carrying off toxins, both liquid and gaseous," and "that it reinforces the natural defences against toxic invasion" [144A].

There are many persons who think that it is better to take only the nourishing parts of food, and save their digestive organs the labour of extracting them; they prefer meat extracts to meat, fruit jellies to the whole fruit, the finest flour to the entire wheat meal; but this is a great mistake, not only for the reason previously given, that is to say, the absence of the stimulation caused by the vegetable fibres, and other solid parts contained in the coarse meal and bran, but also because the stomach and intestines ought to be kept at work like all other organs of the body, provided they are free from ulceration, catarrhal affection, or other disease. Although some meat extracts are useful, the entire meat is more nourishing than most extracts of meat, which do not make muscle, albeit they exercise some influence on the metabolism; the very fine white bread is for the majority of ordinary healthy people inferior to the wheaten bread made from the entire flour, the whole meal bread and any good household bread.

In some persons the insufficient intake of fluid is the cause of constipation, which is often removed by taking more fluid, by preference, especially in the case of corpulency, apart from meals. Another and frequent cause of constipation is inadequate physical exercise. It is for this reason that constipation is more common amongst sedentary women. Many persons become regular by increasing their daily walking exercise from half a mile or a mile to five or six miles or more, or by long rides on horseback, or a good hour's ride before breakfast, or by active games such as golfing, football, and cricket, and by breathing exercises and their action on the abdominal organs (p. 65).

Another help is the methodic contraction of the muscles of the abdominal wall, the *abdominal pressure.* By slowly and thoroughly contracting the abdominal muscles fifty or sixty times or oftener, and by keeping them in contraction during full and prolonged expiration, the peristaltic action of the intestines is promoted, the abdominal muscles themselves are strengthened the liver, the bowels, the blood-vessels, and all the organs within the abdominal cavity are compressed, the entire abdominal circulation is activated, the blood is squeezed out of the veins and more blood is sent to the heart, which, in consequence, is forced to contract more vigorously. These methodic contractions of the abdominal muscles act somewhat similarly to ordinary *massage* by the hands, which often renders purgatives unnecessary. Abdominal massage may be performed in different ways. A method which I have found effective in many persons, is to knead the abdomen thoroughly for five to fifteen minutes after going to bed, and once more in the morning before rising. By this means the peristaltic action of the bowels is encouraged and it continues to move on the contents of the intestines during the night.

In many persons the nocturnal alone is sufficient without the morning massage, while others find the morning massage more effective. Abdominal massage has the additional advantage of counteracting the accumulation of blood in the abdominal veins—abdominal venosity—formerly often designated by the term abdominal plethora.

A glass of hot or cold water, or of some aerated table water like Perrier or Seltzer, or a cup of hot weak tea taken about one or two hours before breakfast often has the desired effect. Many smokers find advantage from a cigarette or a pipe or cigar before breakfast. A wet bandage round the stomach, worn during the night, is likewise to numerous persons a successful measure. If by all these aids, including diet, the regular action of the bowels cannot be obtained, and if the health of the individual suffers in consequence, mild aperients or lubricants become advisable, as suggested by Professor Schmidt and Dr. Neville Wood (p. 181).

The popular view that milk in quantity is a wholesome food for adults is correct only with limitations. Fruit is of great value in the diet of *old people*, even the much-abused rhubarb, though injurious in some ways, probably lowers the *viscosity of the blood.*

Baths of natural salt waters, hot sea water, or ordinary hot water, produce great dilation of the surface arterioles and capillaries of the skin, and tend to lessen the blood in the internal reservoirs and relieve the heart by diminishing the resistance.

XII.—THE NERVOUS SYSTEM.

All the organs and systems of the body are governed by the *nervous system.* We must therefore nourish it, keep it in action, and prevent its decay as long as possible. The state of the blood-vessels and the circulation are all-important. Degeneration of the small blood-vessels of the brain forms a frequent cause of premature decay and death. The tendency to this degeneration, at a comparatively early period, is in many families hereditary ; but this morbid heredity is to a great degree preventable by moderation in food and stimulants, by regular physical exercise, and by judiciously arranged mental work and occupation. I have witnessed this often, and in a striking way in a family whose male members had for several generations all died between 56 and 64 from apoplexy, or paralysis, or softening of the brain. Of five brothers in this family who came under my observation when between 25 and 40 years of age, two carried out the advice to lead an active life, mentally and physically, coupled with great moderation in food and in sleep, and lived to 70 and 73 years, the causes of death being not degeneration of the brain-vessels, but heart affection and pneumonia ; while the three others, with less active and temperate habits, but great indulgence in sleep, died between 60 and 64, from apoplexy and paralysis. I could adduce many similar and even more striking observations in regard to other families.

THE BRAIN.

The *brain* profits like all the other organs of the body by physical exercise, in so far as through the increased action of the heart produced by exercise more blood is carried to it, and the arterioles and capillaries as well as the nerve-cells are kept in activity. Exercise, however, produces another and more immediate influence on the nutrition of the brain. As every voluntary movement is due to an impulse from a certain portion of the brain, this stimulus causes an increased afflux of blood to that portion, owing to which the nerve-cells as well as the small blood-vessels themselves are nourished and kept in working condition, counteracting premature decay. The brain often decays from want of mental work, and this is especially the case towards the evening of life. We have frequent opportunities of witnessing this. Many men retire rather too early from business ;

others, especially officers in the Navy or Army, and civil servants, are obliged to do so by the regulations. Amongst these men we see not rarely weariness, dejection, and an inclination to give up all occupation and active habits, to remain longer in bed, to sleep often by day, to smoke immoderately and sit longer over their meals. Dr. Johnson attributed the fatuity of Dean Swift in his old age, partly to his objection to use spectacles, partly to his retiring from intellectual society, thus shutting out the necessary stimulation of the brain. To this want of stimulation we may ascribe the fact that in remote country districts more people show early decay of the mental faculties than in cities where they converse with friends, visit galleries, have many little excitements, and through this keep up a certain amount of mental activity in advancing years. People who are not obliged to work must make work for themselves. They ought to seek some objects of interest in art or in literature, in history, geography, geology, botany, zoology, in the study of the habits of insects or other animals, in gardening or agriculture, or in travelling, or in adopting and educating a child, and in other philanthropic matters, &c.; they ought to cultivate a hobby, for instance, in collecting plants, butterflies, insects, prints, autographs, antiquities, or coins, by which they are induced to study art, history, antiquity and mythology; even the collecting of postage stamps, in default of something else, can be made a source of mental occupation. The cultivation of such a hobby ought to be commenced while people are still at active work, since the inclination and the aptitude to begin something new disappears frequently long before 60 or 65, when they have to retire from their work. Many old people derive great benefit from chess and other intellectual games, also from games at cards or dominoes, especially when the eyesight for reading fails, provided over-excitement or passion is avoided. The families or companions or nurses of old people ought therefore to play with them, or otherwise occupy them, instead of allowing them to go to sleep for several hours during the day or the long evenings. Amongst the classes of people who die earlier than they ought to do from imperfect brain work, are some who had lived a healthy life up to 50 and 60, but then began to fail from want of occupation or activity. I have observed this, for instance, amongst farmers, who, when they felt less inclination to take the long walks and rides necessary to superintend their farms, allowed their work to be done by their sons, indulged, however, in the comparatively large amount of food to which they had been accustomed, spent the greater part of the day during the long winters indoors, became stiff in their limbs, sleepy and indolent, and died between 66 and 72 from disease of the kidneys, or of the arterioles of the brain, or chronic bronchitis. This may be called a respectable age, but it is not the age which they would probably have attained, if they had sufficiently occupied mind and body, diminished the amount of food, and kept up out-of-door life and exercise. Similar observations I have often made amongst well-to-do tradesmen and other classes, to which I have already alluded. The great war affords many instances of the beneficial influence of mental and physical activity on premature decay. Numerous men of business who had retired from work and had lost health and vigour, have been obliged to return to business because the younger members of their firms had joined the Army. The result is a real resuscitation. Also many retired officers who had become heavy in mind and body, have, after rejoining the Navy or Army, regained their former activity. A great point is to keep up *variety in mental occupations*, and to keep awake the interest in many things so as to prevent mental torpor.

Another advantage of regular, even absorbing occupation is that it prevents us from turning our attention to our own feelings and failings, to our mental and physical troubles. Many persons are apt to pay too much attention to slight ailments, imagine them to be the beginning of serious disease and suffering, and become through this mentally depressed and unhappy. These *imaginings* often give rise to real disease of mind or body, such as hypochondriasis and melancholia.

> "Present fears are less than horrible imagining."—
> *Macbeth* i, 3.

The most effective remedy, preventive as well as curative, of such morbid imaginings and their grave effects, is constant occupation combined with open-air exercise. Dr. Mead says: "In fact, all sorts of bodily exercise are necessary; and in particular, it will be of great service to play at bowls or tennis, to toss the arms quickly to and fro with lead weights grasped in the hands; but nothing is better than riding daily on horseback" [76A]. The latter was considered by Dr. Mead the most useful exercise. All mental occupation leads to increase of flow of blood to the brain, activity of the small blood-vessels and nutrition of the nerve-cells. I have already mentioned Mosso's experiment [86]. I could report the most remarkable proofs of the influence of mental activity on the condition of the heart, the digestion and the whole body. I cannot resist mentioning a very striking case which I had the opportunity of watching from day to day, as the subject was an intimate friend of mine.

A man of great energy and intelligence, who was the leading spirit in a well-known hospital, began to get languid and to lose the interest in his work at the age of 76. The action of his heart gradually became weak and very irregular, he lost the expression of intelligence peculiar to him, the saliva ran constantly from his mouth; and a viscid and acrid fluid from his swollen eyelids; the action of the bowels and the bladder became extremely sluggish; œdema of the legs, and at last effusion into the pleural cavities, showed themselves in his eighty-second year, when suddenly the arrangements at the hospital which he had created and for which he had incessantly worked were in danger of being overturned. This caused violent excitement in him; he began at first to dictate and soon to write letters, he held meetings, and succeeded in saving his arrangements and his influence. Marvellous was the improvement manifesting itself from day to day while this work was going on. The pleural effusion and œdema disappeared, the heart became almost regular, the eyes and mouth returned to their natural conditions, the puffiness of the face subsided, and the intelligent expression came back. He remained in this improved condition over a year, when he died of pneumonia, supervening on influenza.

It was the work of the brain and the joy at his success which caused this astonishing improvement.[1] Wonderful is the effect of *success*, and equally so that of *hope* and *joy*. We may assume that their primary action is on the mind and that it is instantaneously communicated to the centres of circulation, respiration, digestion, and the whole nervous system; including the ganglia. I have often observed that the feeling of mental and physical fatigue was rapidly transformed into the greatest elasticity of movement and flashing of thought by an incident of hope and joy. Less conspicuous but very powerful is the influence of a *joyful habit* of mind on all the functions of the body. Such a habit ought to be, and can be, acquired by most persons through the continuous influence of a strong will, in spite of all that is asserted to the contrary by those who will not exert themselves.

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[1] "True hope is swift and flies with swallow's wings,
Kings it makes Gods, and meaner creatures Kings."—
King Richard III, v. 2.

Instances of the immediately fatal effect of bad news are known to many persons, but the same fatal effect occasionally, though much more rarely, occurs from joy at unexpected good news. One of the most remarkable cases of this kind is related by the former American ambassador in Berlin, James W. Gerard, in his interesting book "My Four Years in Germany" (Hodder and Stoughton, 1917). When it was announced to the civil prisoners at Wittenberg "that they were to be taken from Wittenberg to another camp, one of them was so excited by the news of release that he fell dead upon the spot" (p. 120).

The opposite conditions of the mind, such as *grief* and *loss of hope*, cause depression of the whole organism. In many people amongst the prominent effects is a change in the gastric, intestinal, hepatic, and pancreatic secretions, with vomiting and diarrhœa and total loss of appetite, followed by emaciation and anæmia. Shakespeare shows his knowledge of this effect, where he makes Agamemnon address the Greek Princes with the words:—

"What grief has set the jaundice on your cheek?"—
Troilus and Cressida, i, 3.

In others we observe principally the mental phenomena, total indifference for their surroundings, combined with or followed by at first functional, afterwards organic changes, especially dilatation of the heart, and death from what may truly be called a "*broken heart*." Diminished respiration, weakening of the action of the heart, and imperfect supply of blood to the brain, have a great share in these conditions of depression. Sometimes, as in the case of the man just described, but not always, we are able to produce a favourable turning by awakening an interest in near relatives or friends, or by some other powerful mental influence, which leads to arousing the depressed functions of the brain, the heart, and the rest of the body. Of many cases of this kind which have occurred to me, I will narrate only one more:—

A lady, 70 years of age, lost suddenly from acute disease her husband, a very distinguished physician, whom she had adored, and with whom she had shared every pleasure and every sorrow throughout their long and happy union. She was highly cultivated, very active, and took a lively interest in all her surroundings. Immediately after the unexpected death of her husband she became mentally depressed and perfectly helpless, while formerly she had been full of resources. The condition might be called "*mental paralysis*," or "acute melancholia." It was almost impossible to induce her to take food; she sat in a corner of the room with her head bent down, frequently sighing, and took scarcely any notice of the members of her family, of whom she had always been very fond. Within less than three weeks the heart, which had been quite sound before her great loss, had become dilated, the pulse had become excessively weak, only 50 to 55, and irregular, and a loud systolic mitral bruit had developed at the apex. The legs had become œdematous. The intellectual and sympathetic physiognomy had turned into an expression of apathy and stupor. This state continued for some weeks; she became greatly emaciated and was expected shortly to die, when as a last experiment an urgent message was sent to her from a daughter who had not been able to leave her bed for several years, and had entirely depended on her. The daughter implored her to see her once more before she died; the mother was carried to her, and her maternal interest and affection were aroused by the daughter's grief and attachment. She took some food and stimulant while with her, revived from that moment, and was daily carried to this invalid daughter, whose joy at her mother's arrival seemed to act as a powerful stimulus on the latter, who gradually regained her interest also in other members of the family and in life in general. The aged lady recovered her health in the course of three months, although the heart remained somewhat dilated and irregular; she became again the centre and soul of her large family, and retained her faculties until her death, in her eighty-sixth year.

Persons in despair should not be left alone.

> "Why do you keep alone,
> Of sorriest fancies your companions making."
> *Macbeth*, iii, 2.

Almost equally as injurious as grief and sorrow is *worry*, by which the sleep is disturbed, the equanimity destroyed, and the joyful performance of the daily work and duty rendered impossible. The habit of some persons to make worries ought to be counteracted from an early period by all possible means.

It may not always be quite easy to explain the physical mode of action of happiness and allied mental conditions on the one side, and dejection and unhappiness on the other, but if we consider the immediate effects which in most persons emotions produce on the action of the heart and blood-vessels, including the capillaries, it becomes more intelligible. The palpitation of the heart and the flushing of the face under the influence of joy or shame, the paleness and feeling of coldness and shivering, from fear, grief and anguish, clearly show the intimate connection between mind and heart, which is so constant that both words are, in common parlance, often used in the same sense. On watching persons under the influence of deep despondency and grief, I have often found their breathing superficial and irregular, interrupted occasionally by a sigh, and their pulse weak, and often irregular; while on the arrival of joyful news the breathing became immediately deeper, and the pulse fuller and regular, rising within a few minutes from 50 to 70 and 75, its habitual rate of frequency. Evidently the centre of the pneumo-gastric nerve is influenced by these opposite forms of emotion. It is often impossible to remove sorrow, grief, mental anxiety and depression by friendly encouragement, but we must endeavour under such circumstances to counteract these injurious agencies by mental and physical means. Urgent work is helpful, if it can be procured, but all exercise, active or passive (in carriage or bath-chair), in the open air is valuable, and rarely fails gradually to exert a beneficial effect; change and travel are also useful.

There can be no doubt that *pleasure* is often a cause of *happiness*, but it is by no means identical with it, and the habit of *pleasure* *hunting* is the frequent origin of unhappiness and melancholy. The pleasures of life must be enjoyed with temperance. Sources of *mirth*, however, are not altogether to be avoided; hard workers are often benefited in themselves and in their work by an occasional visit to the opera, the theatre, a concert, or even a merry dance; but we must always keep in mind the wisdom of Dr. Mead's aphorism: "Pleasures are heightened by a sparing use" [76A]. Not to be confused with pleasure is *cheerfulness*, and in order to promote *cheerfulness* we must cultivate *contentedness* with the circumstances in which we are placed, and fight discontent with the whole power of our reason, as one of our greatest enemies. If we do not possess all we wish for, we must think of others who are much less fortunate than ourselves. "Gladness of heart is the life of man, and the joyfulness of a man prolongeth his days." It is, further, of great importance to educate the *sense of duty* with regard to one's position in life and to one's surroundings. Indeed, all important though exercise, diet, moderation and work are for the prolongation of life, they are greatly helped by attention to duty. This has been recognised long ago, and a Chinese author of a judicious

"Makrobiotic" in the XVth or XVIth century, regarded "*virtue*" as the greatest power for longevity. A person who does his duty and, through this, has a *good conscience*, is, other matters being satisfactory, happy; and even if the circumstances are not to his liking, if he meets with losses and disappointments, he is able to keep his equanimity, and to make the best of the situation. On the other hand, a man who has reason to be dissatisfied with himself, or has a *bad conscience*, is frequently unhappy, looks at the circumstances surrounding him in a mistrusting and despondent manner, and is less able to extricate himself out of difficulties; he often becomes depressed, his resisting power is lowered, he is easily attacked by disease, and this all the more easily so if he feels that his misfortune is due to his own dereliction of duty. The head of the family, for instance, who neglects the happiness of his wife and the training of his children for his personal enjoyment or ambitious reasons, and a wife who shirks her duty of bearing children and of nursing them for frivolous motives, fine clothes and social excitement, often prepare for themselves worry, disease and premature death.

Dereliction of duty is often revenged not by the law but by the conscience and by unhappiness.

On the other hand, the cultivation of the sense of duty leads to contentedness; and those who bring sacrifices for home and family, for the alleviation and improvement of the condition of the destitute, of the sick and helpless with whom they come in contact, earn *self-respect* (a great force for good) and *mental satisfaction* and *happiness*, which act like sunshine on the whole body, and thus become means of prolongation of life and of a happy old age. A further point of *self-education* connected with the sense of duty is the *restraint of our passions*, which strengthens the mind. By *losing our temper* and "flying into a passion" we gain nothing, and often do much harm to ourselves and others; but it is not generally recognized that an attack of high temper (anger, fury) often causes great bodily injury. I have repeatedly seen attacks of epilepsy, of apoplexy, and even sudden death result. We all know the changes in the expression, the sudden rushing of blood to the face and eyes; the same rush of blood to the brain may cause rupture of a diseased blood-vessel, since the blood-pressure may suddenly rise 15 to 20 degrees by an attack of anger (Oliver). By the power of will we can gradually subjugate a quick temper, and can conquer undue ambition,[1] vanity, covetousness, avarice, prejudice and jealousy.

> "The venom clamours of a jealous woman
> Poison more deadly than a mad dog's tooth."
> *Comedy of Errors*, v, 1.

Unless we bring our passions into entire subjection, they become our tyrants. Bacon says: "Avoid envy, anxious fears, anger, fretting inwards, subtle and knotty inquisitions, joys and exhilarations in excess, sadness not communicated" [8]. Another part of self-education is the duty of combating *self-indulgence*, with regard to excess in food, drink, idleness and sensual pleasures. Self-indulgence leads to moral and physical weakness, want of resisting power to disease, and mental depression; *self-control* leads to increased mental and physical strength, and to contentedness.

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[1] "Ambition" is not to be absolutely condemned; a certain amount of ambition is to many persons useful as a stimulant to learning and progress; it is almost needful to the soldier; but "undue ambition," as depicted by Shakespeare in Lady Macbeth and in Cardinal Wolsey, often leads to injustice towards others, and to crime.

> "I charge thee, fling away ambition;
> By that sin fell the angels."
> *King Henry VIII*, iii. 2.

We must endeavour to promote *good humour* and *cheerfulness* by the arrangement of our whole manner of living, as far as lies in our power, without neglecting our duty. By both we benefit not only ourselves, but also those with whom we come in more or less intimate contact. We must endeavour to cultivate the sense for *beauty* of Nature and art. It is not luxury which we want, but that beauty which can be enjoyed without riches, in the most simple things, common to all. By awakening the sense of beauty we open up a rich source of the purest spiritual enjoyment and thus bring food to the brain, the governor of all the organs of the body. Much can be done in this way, for instance, by books, by flowers, by pictures and drawings at home, in cottages, public schools, hospitals and sick rooms. Bacon recommended "studies that fill the mind with splendid and illustrious objects, as histories, fables and contemplations of Nature." We further must acquire the habit of *concentration*, to which Gladstone attributed his success, and *thoroughness* in our work, and must avoid too great multifariousness, which leads to haste and hurry. Habits of *haste* and *hurry* prevent mental satisfaction, over-excite the heart, and gradually injure its nutrition and structure. While well-regulated work, adapted to the individual powers, strengthens the brain and heart, ill-regulated or ambitious work exceeding the mental power of the worker, deranges them, and often leads to different kinds of premature breakdown. Sir William Osler says in his address to the Yale students (April, 1913), in his own graphic way: "One of the saddest of life's tragedies is the wreckage of the career of the young collegian by hurry, hustle, bustle and tension—the human machine driven day and night, as no sensible fellow would use his motor" [99].

We must cultivate *restfulness* and *equanimity*, and the habit of looking calmly on the events coming before us, not disturbing ourselves with unnecessary fears.

The equanimity, associated with the absence of worry and anxiety, which is a feature of "rentiers," life-annuitants and pensioners—prominently the ex-Lord Chancellors of England—is one of the principal causes of their almost proverbial longevity.

A further powerful agent in creating and maintaining health of mind and body is *the will*.

We must develop it from youth and cultivate it throughout life. An effective influence in this respect is exercised by our endeavouring to carry out in our daily life what we think good and right towards others and ourselves, in great as well as in small matters, even under difficulties, and with sacrifice of pleasure. Our persevering in our daily walks, even in disagreeable weather, is one of the many instances in this direction, and the practice of moderation in sensual enjoyments is another. A strong will is a powerful agent, preventive as well as curative, with regard to neurasthenia and many forms of neuroses. Amongst a number of persons exposed to the same injurious influences, such as intense cold, draught, want of food, vitiated air, some by a strong will escape disease, while others, especially feeble-minded subjects, are overpowered. A large proportion of those whose lives I have been able to influence and prolong, exercised their strong will in carrying out the precepts which I gave them, although they appeared to them at first tedious and difficult. *I will not decay early*, they said, *I will maintain my powers and faculties* as long as possible. And not only is a strong will a great aid in attaining longevity, by maintaining health and preventing disease, but it is also a powerful agent in overovercoming disease, especially chronic disease. I have seen many, and amongst them some marvellous, cases. The will is, indeed, a great power in disease as well as in other conditions of life.

These considerations of functions of the mind bring me to the borders of *mental diseases*, which often, though not always, shorten life. In many cases there is a hereditary tendency, but this can often be counteracted successfully by means of promoting the general health, by strengthening the balance of the mind, by healthy occupation and exercise, by enlightened mental surroundings, by great moderation; by cultivating contentedness and hopefulness, and by governing the passions, while at the same time all exciting causes, including intemperance, self-indulgence, ill-regulated or ambitious mental work, must be prevented. Sir Samuel Wilks ("On the Correction of Hereditary Tendencies," *Lancet*, October, 1903, p. 1,151) points out as means of cure, change of mental surroundings, from the houses of vicious parents or relatives to healthy surroundings or schools, where the qualities of self-respect, integrity, independence, and a just dealing with others, are brought out.

Lord Bacon, in his "Advancement of Learning," speaks of particular remedies "which learning doth minister to all the diseases of the mind."

In regard to the mental condition and the influence of mental work, provided the work is well arranged and not excessive, I must again express my conviction against the doctrine that under ordinary conditions work *wears out* the organs sooner than great restriction in work. It certainly is wrong with regard to healthy brains, if the work is well arranged and is not "overwork." Judiciously arranged mental work in itself, with fair intervals of rest, does not wear out but strengthens the brain, in the same way as the power of the heart and the blood-vessels and muscles is maintained and strengthened by adequate physical exercise. The mental faculties ought to be exercised during the greater part of the day and the whole year, holidays included, but there ought to be a change in the nature of the work, so that one sphere is in a comparative state of rest while the other is employed. Dr. James E. Pollock [107] says very well: "Sameness begets weariness, causes the mind to grow old and accelerates bodily decay." To many serious workers it is most beneficial to seek occasionally changes causing pleasure, such as music, or plays causing laughter and mirth. Shakespeare with his marvellous insight into matters of health, physical as well as mental, is our great teacher on this, as on many other, subjects :—

> "Your honour's players, hearing your amendment,
> Are come to play a pleasant comedy,
> For so your Doctors hold it very meet ;
> Seeing too much sadness has congeal'd your blood,
> And melancholy is the nurse of frenzy.
> Therefore, they thought it good to hear a play,
> And frame your mind to mirth and merriment,
> Which bars a thousand harms and lengthens life."
> —"Taming of the Shrew," Induction, Sc. II.

In the majority of people who exercise their mental faculties judiciously, intelligence is retained longer in fair energy than memory, the senses, and the functions of the muscular and digestive systems. We find, at all events, statesmen, judges, orators, doing almost their best work after 50 and 60. We have fortunately many instances of great brain-workers attaining considerable ages and maintaining their faculties to the end, in science, in arts, in politics, in the law and divinity, and also in medicine. Cicero says "the intellectual powers remain in the old, provided study and application are kept up, and old age need not be inactive, indolent and drowsy." We have striking instances amongst painters, in Giovanni Bellini, Michelangelo, Titian, Franz Hals, Sidney Cooper and others; we have amongst statesmen, brain-workers, philanthropists, poets, musicians and doctors, Hippocrates, the father of medicine, who is stated to have lived to 104; Sophocles, who wrote a tragedy at 73, and is said to have written others still later in life; Plato, who in his 81st year, died while writing; Isocrates, who wrote the "Panathenaicos" in his 94th year, and lived five years after; Democritus of Abdera, the philosopher and naturalist, who is said to have lived 109 years; Varro, the most learned of the Romans; Plutarch, who in addition to his other works wrote rules on the preservation of health; Galen; Cato ("the Censor"); Cicero; Fontenelle; Thomas Hobbes; Cornaro, who wrote a comedy at 83, and his discourses on a sober and temperate life between his 83rd and 95th years; Sir Isaac Newton; Dr. Richard Mead; Heberden; John Howard; John Wesley; Benjamin Franklin; Cherubini; Goethe; A. von Humbold; Professor Chevreul; Victor Hugo; Voltaire; Sir Henry Holland, the physician; Oliver Wendell Holmes; Sir Moses Montefiore, the philanthropist; William I. of

Germany; Moltke; Dr. Holyoke, the American physician; Manzoni; Leopold von Ranke; Mommsen; Gladstone, the man of physical and mental vitality; Lord Masham, the great inventor in modern industries; Mrs. Elizabeth Hanbury; Madame Viardot, the celebrated singer; Lord Wemyss; Lord Strathcona; Sir Charles Tupper, the Canadian Prime Minister; Sir Henry Pitman, the Emeritus Registrar of our own College, who lived to above 100; Sir Francis Galton, the great worker in anthropometrics, heredity and eugenics; Tolstoy, not only author and reformer, but adept in, and admirer of manual labour; Miss Joanna Hastings, sister to Sir Charles Hastings, the founder of the British Medical Association; Manuel Garcia, the inventor of the laryngoscope; Sir W. Huggins, the astronomer; and very many who contributed through their work to the pleasure and benefit of others and to their own happiness and longevity. We have, on the other hand, good reason to assume that neglect of the mental faculties, idleness and excessive amount of sleep, lead to premature decay of the brain functions and to shortening of life. We must, however, not allow the conviction that *mental work* is one of the greatest sources of happiness and long life to make us disregard the danger of *mental overstrain* during different periods of life. In children and adolescents it interferes with physical and mental development, and often causes various conditions of malnutrition and tuberculosis. It is, therefore, necessary for parents and teachers to look for signs of cerebral fatigue, such as want of appetite, indigestion, headache and irritability, and to prevent mental strain by interspersing the hours of mental work with periods for active games. It is especially important to forbid the work for competitive examination when the mental powers are inadequate, either temporarily or permanently. Mental breakdown is often attributed to overwork, when it is due to misdirected work, to worry, to want of exercise, to the indulgence in large meals, alcohol and sensuality, while doing at the same time hard mental work. The majority of the harmful effects of excessive mental work can be avoided by the adoption of periods of complete rest, or of change of work, or of holidays. The arrangement of *holidays* requires more careful consideration than it often receives. It ought to be different according to the position, the occupation, the age, the temperament, the health and strength of the individual, and ought to be a real holiday, a cessation of the usual work, a change to some other kind of occupation, for instance, the study of art, or zoological, botanical, geological or archæological subjects, or travelling. A strong person in early manhood will gain most by climbing, or sailing with active management of the boat. A young man may be satisfied with some weeks, but a hard-worked man after middle age may require as many months or more. In the life of every day, independently of holidays, there ought to be a break from the principal work, and this break ought, with rare exceptions, to be a time of *recreation*,[1] for genial conversation, reading, interesting games, or the cultivation of a hobby. We all should like at times to go on with our work without interruption, but nature is inexorable, and obedience to the *laws of nature* is one of the greatest sources of happiness and long life. *Moderation* is one of these laws, and is demanded not only in food and sensual enjoyment, but also in mental and physical work.

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[1] Shakespeare makes one of his female characters say:—

> "Sweet recreation pass'd, what does ensue,
> But moody and dull melancholy,
> Kinsman to grim and comfortless despair."
> —"Comedy of Errors," V, 1.

We need not conceal from ourselves that we do not retain in old age the same rapidity and force of thought, and as good a memory as we enjoyed in youth and middle age; but we must not allow ourselves to become depressed by this or to give up mental work. We must endeavour to retain our mental equanimity and do as much useful work as we can. In this way a feeling of contentedness is produced which exercises the most beneficial influence on the whole organism. Nothing is more injurious to old persons than the idea that they are useless, that they cannot any more do anything either for themselves or for others, that they are only burdens to their friends, and that they must die soon. I have often seen people of advanced age rapidly decaying, when through some unhappy influence they allowed themselves to be seized by such ideas; but I have also had repeatedly the satisfaction to see such despairing persons recover strength and activity and happiness, when one succeeded in reawakening self-confidence and hope. This fact cannot be strongly enough impressed on the aged themselves and on the friends surrounding them.

Pessimism is always to be condemned; it is depressing and prevents our making the best of our position. It is under circumstances quite right to acquire a full insight into the dangers and disadvantages of our situation and condition, but we must at the same time diligently search for the means to remove or at all events to mitigate them. We are not in favour of blind optimism, but of realism, and this realism not rarely leads to victory.

Many people have been startled by a statement in Sir William Osler's Valedictory Address at Johns Hopkins University [98] about the comparative uselessness of men above 60, and that all the effective and vitalizing work of the world is done between 25 and 40. His partly jocose remarks seem to have been misinterpreted. I understand them much in the same way as Sir Samuel Wilks does in his paper "De Senectute" [144]. He thinks that the principal activity, we may call it the creative period, ceases in the middle of life, viz., about 50, that, however, judgment and ability to do useful work may last to much more advanced life. To use the words of Sir Samuel Wilks: "Men (older than 50) may still continue to take their appropriate share in the affairs of life, The work which they then do need not be original and new, implying a retention of the same mental activity as they had previously possessed, but rather the turning to account the knowledge which they had previously gained, and so utilizing their experiences for the benefit of others as did the Nestors of old." Sir William Osler is himself a striking instance that life long after 40 may be very useful, by his example, by his literary work, by the way in which he fulfils his manifold functions as Regius Professor of Physic at Oxford, as President or member of several medical and scientific institutions, and by the influence he exercises on the young men entering their professional career. *Dryden* in his advanced age boasted that his mental faculties were as vigorous as ever, when he says in his Preface to the Fables, "What judgment I had, increases rather than diminishes, and thoughts, such as they are, come crowding in so faſt upon me that my only difficulty is to chuse or to reject, to run them into verse, or to give them the other harmony of prose" (34).

XIII.—SLEEP.

"O sleep! O gentle sleep!
Nature's soft nurse!"
Shakespeare, *Henry IV*, Part II, Act iii, Sç. 1.

In association with the nervous system we must discuss the subject of *sleep*, that most wonderful function of our organism, the

"Blessed barrier between day and day,
Dear mother of fresh thoughts and joyous health."
(Wm. Wordsworth.)

It is well known that the late Arthur Durham, of Guy's Hospital, found by experiments on animals that in sleep there is a certain degree of anæmia of the brain, and it is now generally assumed that the circulation in the small blood-vessels of the brain is intimately concerned with the function of sleep. Mosso's [86A] experiments on persons with holes in the skull from accidents show that the volume of the brain during sleep is less than during waking, while the volume of the limbs is greater through increase of the amount of blood in the blood-vessels. Dr. G. Oliver points out that during sleep the arterial pressure falls, the venous rises, and that the tissues are irrigated with lymph, which leads to their restoration and nutrition. The amount of sleep required differs very much, in different people and at different ages, and even in the same person at different times and under different circumstances. Children and young people require much more than adults. Sleep promotes with them nutrition and growth; it is to them the "great nourisher in life's feast" (*Macbeth*, Act ii, Sc. 2). Persons affected with anæmia ought to have longer hours of sleep than healthy persons, since during sleep the amount of hæmoglobin is increased; full-blooded individuals should avoid much sleep. Most adults do not require more than five and a half to seven hours, but some take nine hours or over. Much depends on the nature of occupation and on habit, and there are in this matter, too, good and bad habits. Sleeping too little for one or many months, say under six hours in children between 8 and 14 years of age, and under four hours in adults, causes in most subjects impairment of digestion, sanguification and nutrition, emaciation, anæmia, mental irritability, headache, neuralgia and other mental and physical disturbances. This is easily understood when we take Oliver's observation just mentioned into consideration, for we learn from it that too little sleep gives insufficient time for the process of nutrition of the tissues. Oliver's observation also shows why during active growth much more sleep is required than in the later stages of life; when the body is thoroughly developed; and why the curtailing of sleep in children and growing persons is so much more injurious than in adult life. Dr. T. D. Acland has not long ago judiciously discussed this subject [1]. Women seem to require, and take, as a rule, half to one hour more sleep than men. The habit of sleeping too little is, however, less frequent than that of sleeping too much. There are some hard brain-workers who never sleep more than five hours, or even less, and enjoy good health with this small amount up to old age, if they live otherwise correctly. There are many persons who worry themselves if they sleep less than seven hours and if they wake several times during the night. They mostly harm themselves more by worrying about the supposed too short hours of sleep, than the relatively slight diminution of sleep harms them; *and if they can be persuaded that they are not injured by the* shortening, and that rest in bed by itself leads to restoration of the body, they usually begin to sleep better. I have experienced this both in others and in myself.

I have been a bad sleeper from an early period of my life, but especially after the age of 28, when for more than thirty-five years I rarely was in bed more than six hours, and awoke almost every night twenty times and oftener. At first the idea that this must weaken my working power worried me and lengthened the waking intervals between the spells of sleep; but when I gradually learned that my health did not suffer and that I could do my work and keep my weight in spite of imperfect sleep, the waking intervals became shorter. What, however, was most helpful to me, was the giving up writing professional letters after 10 p.m., and occupying myself for an hour or more with the study of Greek coins, Greek history, geography and mythology. Similar occupation with a hobby in the late evening hours I have found also most useful to numerous other persons. They explained it themselves by saying that such occupation removed their thoughts from anxiety and worry:

> "Where care lodges, sleep will never lie."
> —"Romeo and Juliet," II, 3.

Many, however, I could not persuade, but on waking early in the night they turned their thoughts to their occupations or worries, and as everything looks blacker during the night than in broad daylight, they dreaded this so much that they took alcoholic drinks or "sleeping" drugs either on going to bed or during the night as soon as they woke up. This is a very bad habit and narcotic drugs ought never to be resorted to excepting under the well-considered advice of the doctor. The frequent use of anodynes and sleeping remedies (narcotics, hypnotics, soporific drugs) weakens the heart, the nervous system, the digestion and the resisting power of the body. Among the means frequently used is a dose of alcohol (Cognac, whisky, rum) at bedtime or on waking during the night. Although I am aware that a small quantity of alcohol, say a dessertspoonful or a tablespoonful of whisky or Cognac in a little milk or water taken at bedtime, often produces sleep, it ought never to be allowed to become a habit, and its use ought to be restricted to rare exceptions, like that of chloral, opiates, and other somnific medicines.

In some obstinate cases of sleeplessness I have employed with advantage a proceeding which obviously can only be used exceptionally. I made the patient lie in a hammock or a rocking bed or chair, and they were moved to and fro by an attendant, in imitation of nurses putting babies to sleep.

In all cases of so-called sleeplessness, it is necessary to inquire whether the actual amount of sleep obtained is really insufficient, and if so, we must endeavour to find the cause and to remove it. We should first attend to the rule mentioned by Professor Halliburton [50B], "diminution of the impulses entering the central nervous system by the afferent channels," which means closing our eyes and securing absence of light and noise, and obtaining a comfortable position. We must also endeavour not to think and keep off all mental activity, since more blood flows to the brain when thinking than when the brain is inactive (Mosso, p. 185 [86]). The tendency to sleep badly can often be corrected by taking a slight meal on going to bed, or on waking during the night, such as a cup of milk or milk-gruel, one or two plain biscuits or some light farinaceous food. This leads to more blood being attracted by the stomach and the amount of blood in the brain being diminished, and it also acts on the mind like a suggestion. In some persons a late full dinner or supper or an injudicious article of food, or coffee or tea at a late hour, is the cause of imperfect sleep ; another cause is exciting mental work or correspondence or an animated conversation at late hours. In every case one must endeavour to find out the cause and try to remove it. In some people a wet bandage round the abdomen improves sleep. Many persons who awake too soon and cannot go to sleep again will do so if they arrange their pillows or if they get out of bed for a few minutes. Reading or being read to is useful to many. Not rarely I have found too great heat and closeness of the air of the bedroom the cause of bad sleep, and the cure in the open window or in the placing their bed on the balcony or in an open shelter in the garden. Insufficient exposure to the open air is in some persons the cause of sleeplessness. In many instances walking or playing golf for two or three hours, driving in an open carriage or in a bath chair twice a day for two hours is quite successful. In persons with cold feet, a hot water bottle often proves an efficient remedy, again in others an extra woollen blanket, and in hot weather the removal of the greater part of the bed clothes. Prevention of noise is to most persons a great help ; in accordance with Halliburton's rule, just mentioned, a good sleep promoter to many people is a hot bath before going to bed; much blood is attracted by this to the surface and withdrawn from the brain. The effect is often increased by general massage after the hot bath. Sir James Sawyer has treated the whole subject of "Insomnia" in an exhaustive manner, and has given excellent advice in his lectures on this subject [117].

Much sleep, viz., over eight hours—I speak here of adults—is mostly more injurious than too little, especially in persons of full habit, by causing diminution of nervous energy, degeneration of the small arteries and capillaries of the brain, and in consequence apoplexy or premature decay of mental faculties. I have seen this in several of my best friends, amongst them a justly celebrated physician. Dr. Mead [76A] says in "Regimen of Life" that "excessive sleep blunts the senses and renders them less fit for the duties of life." Immanuel Kant, who was not only a great philosopher but also a student of physics and natural history, and the owner of very judicious views about health and most matters of life, says that much sleep exhausts the energy and shortens life [66]. Sir John Sinclair [120], in his "Code of Health," says: "It is proper to add, that nothing is more pernicious than too much sleep. It brings on a sluggishness and dullness of all the animal functions, and materially tends to weaken the body. It blunts and destroys the senses, and renders both the body and the mind unfit for action. From the slowness of the circulation which it occasions, there necessarily follows great corpulency, a bloated habit of body, and a tendency to dropsy, lethargy, apoplexy, and other disorders."

The time for sleep is the night, and sleep during the day, which is so necessary for infants, ought not to be indulged in by healthy persons in middle life and only moderately so by old people, with few exceptions, as for instance after severe illness, serious mental trouble, or exhausting work. It is a bad habit to transform the night into day and the day into night, to do mental or social work after midnight and to sleep in the morning until 9 or 10 and later. With few exceptions the long-lived reported on and analyzed by the "Collective Investigation Committee" (Humphry, "Old Age") rose early and went to bed early, and my own observation is entirely in accordance with this.

There are, I need not say, a few necessary exceptions to this rule, such as men in the

House of Commons, if the sittings last till 2 or 3; sick nurses or medical men who have spent the greater part of the night at the bedside of a patient; or workers on morning newspapers. It is at present in England the habit of most men occupied with literary work which cannot be done during the day to do it during the late evening hours and after midnight; they say that they cannot collect their thoughts and bring them into proper shape in the morning, but can do so in the late hours of the evening and during the small hours of the morning. I acknowledge that it frequently is so, but I maintain that this is only the consequence of a bad habit, and that for those who accustom themselves to it, the morning work is the best, and that this is also more in accordance with the laws of health. Many people, it is true, cannot work well for several hours in the early morning with an empty stomach; but by taking on rising a cup of milk, with a piece of bread, or of weak tea with milk and a biscuit, they can do their mental work, or take early walks with great advantage. John Wesley, the well-known divine, it is stated, rose for sixty years every morning at 4 o'clock, and never slept more than six hours. Sir Julius Benedict, the musician and composer, told me that from an early period of life he mostly slept only four hours; he lived to 81. I could give numerous instances of great mental workers who from the beginning of adult life were in the habit of rising always between 5 and 6 o'clock, even if they had been obliged to remain up till after midnight once or twice a week, and who lived and retained their working power, in spite of these short hours of sleep, to from 75 to 85 years of age, or even longer. Several judges of my acquaintance, while on duty, rise at 4 or 5 and prepare themselves for their work without apparently shortening their lives.

XIV.—THE SKIN.

An important organ, by which the general health and the duration of life are powerfully influenced is the *skin*. It is the chief regulator of the body heat; it has a great share in the excretory functions of the body, and reflects the impressions from without on the different parts of the nervous system. In old age the skin becomes drier and less elastic, and many of the capillaries become obliterated. All active exercises help in keeping up the circulation in, and the functions of, the skin, but one of the most powerful means is the *bath*. Many persons with an active circulation can use cold baths from early life to very old age; others with poor reaction, especially weakly rheumatic subjects, do better with a hot bath; again, others begin best with a hot bath and then let in cold water and sluice themselves, head included, thoroughly with cold water, or take a short cold shower bath at the end. By exposing the skin and its blood-vessels to an alternation of heat and cold, we nourish and strengthen the different components of the skin and enable them to react more quickly to the changes of the external temperature and thus prevent chills. The hot bath has, in addition to its local effects, an immediate influence on the distribution of blood through the different parts of the body. The heat of the water attracts a large amount of blood to the skin, and diminishes the amount contained in the internal organs. It ought, therefore, not to be taken soon after a principal meal, when the stomach requires a larger amount of blood. Forcible friction with a rough towel after the bath forms the best means of massaging the skin. This *massaging of the* *skin* increases and maintains its vigour and its resisting power, and thus prevents chills, rheumatism, catarrhs of the mucous membranes of the respiratory as well as digestive tracts including the throat and the Eustachian tubes. The bath checks the tendency to asthma. It is a great ally of the kidneys. In addition the bather is obliged to make many movements with the arms and the muscles of the trunk which he would not make otherwise. Friction of the skin, in some form or other, has been much employed in connection with bathing, from ancient classical to modern times, for the sake of health, and often also for mere enjoyment. The usefulness of friction of the skin can be further enhanced by combining it with strong pressure on and pinching of the subjacent muscles.

Thus baths act as a kind of gymnastics not only for the skin itself but also for the muscles of the arms and other parts of the body. The bath, either cold from the beginning, or first hot and then cold, helps to preserve the elasticity of the blood-vessels of the skin, strengthens the heart, and also assists in maintaining the energy of the nervous system. The Japanese have a very high opinion of the usefulness of the daily bath; every hamlet in Japan has its public baths, hot and cold, the former generally preferred. The Hindu, Mr. S. M. Mitra informs me, is obliged by his religion to take a bath every morning before he takes any food.

By the regular use of the bath, and attention to scrupulously clean underclothing we are able to prevent almost all diseases of the skin; and by the proper use of the nailbrush we can keep the nails, those important appendages of the skin, in a healthy condition.

With the ordinary bath we can conveniently combine a short *air bath* by keeping the body uncovered for five to ten minutes or more after the drying and rubbing process has been finished, while the skin is in a state of turgor or glow. This exposure of the whole body to the action of the air increases the tonic influence of the bath. Various gymnastic exercises with the arms, legs, and trunk ought to be combined with this air bath after the water-bath. The air bath alone during some minutes to half an hour and longer, if used with judgment, improves the resisting power of the skin, counteracts the liability to "colds" and "rheumatism," and exercises a beneficial influence on the nervous system and the metabolism. Those who have time and opportunity can take a *sun bath* by exposing the naked or nearly naked body during five minutes to half an hour and longer to the active rays of the sun. The light of the sun, combined with the heat, exercises a more powerful influence than the hot air bath on the general metabolism; it is especially beneficial in chronic rheumatic ailments. Treatment by *electric light baths* and *hot sand baths* is based on similar principles. It is easily understood that the air bath alone, without heat, abstracts warmth from the body according to the external temperature and the degree of movement of the air, and that the duration of the air bath must be regulated according to these influences and the condition of the individual; a remark which applies also to all other forms of baths. The ordinary *Turkish bath*, if properly used, constitutes an effective and popular agent for maintaining the cleanliness and health of the skin, but, as it is frequently employed for therapeutic purposes without medical advice, it is likely to be often abused, for instance, by individuals who are the subjects unknown to themselves and their friends of serious degenerative cardio-vascular conditions.

A kind of local air bath is obtained by walking and driving whenever possible with the head uncovered. Many chills which are caused by cold draughts on the head can be thus avoided. The tendency to headaches is often removed and most people feel fresher with the *head bare* than covered. Microbes are destroyed by the free exposure to light and air; the different kinds of headgear cause increased heat of the air surrounding the scalp, and thus act as incubators of germs. The founder of the Bluecoat School deserves praise for the law to keep the heads of the boys uncovered in all weathers.

If a full bath cannot be managed, a hip bath combined with sluicing the head thoroughly with cold water may be substituted; and if this, too, is impossible, the whole body ought to be rubbed vigorously with a wet towel once or twice a day.

It may seem almost unnecessary to insist on frequently washing the hands; yet this important function is very often neglected. To prevent disease is the first rule for prolongation of life, and many diseases are prevented by washing the hands as soon as possible after having touched anything unclean, including sick persons and articles in contact with them; but even without having knowingly come in contact with unclean things, it is prudent to wash the hands before every meal. As the hands often come in contact with unclean or infected things, it is a good rule to keep them away from the inside of the mouth and of the nose unless they have been washed.

In connection with the skin we must say a few words about the *hair*, which is not a mere appendage or ornament, but is also an organ of protection. The hair undergoes, with the advance of age, considerable changes, which are especially noticeable in the hair of the head, including the beard. There is a wide difference in different persons with regard to the quantity and quality of the hair and the changes occurring in it during life. There are whole families in the members of which the hair begins to turn grey soon after 20 or 30, while in other families the hair retains its original colour up to 60 or 70 or even 80 or the end of life. Similar is the difference with regard to the *loss* of hair, which commences in some families before 25, while members of other families retain their hair up to the most advanced age. The mere change of colour in itself, especially when it is due to a family peculiarity, is mostly no sign of deterioration of health. Lord Bacon justly observes: "Early grey hairs, however they may seem forerunners of old age approaching, are no sure signs, for many that have grown grey betimes, have lived to great years. Nay, hasty grey hairs without baldness is a token of long life." The rapid loss of hair, when it is not due to heredity or the effect of acute disease, is not rarely caused by a lowering of the whole constitution, and thus requires the serious attention of the doctor. In many instances we are able to prevent, or at all events to retard the loss of hair, and to some degree also the change of colour, by sponging the head regularly with cold water, and by keeping it cool and mostly uncovered as already alluded to (p. 231). It is not the custom to walk in the streets with the hat or cap off, but whenever it can be done in fair weather in the parks and in the country it is useful to do so. A further beneficial measure is the *daily massage of the head*, which ought to consist not in mere rubbing of the hair and skin of the head, but also in actively and rapidly moving the scalp to and fro over the bone, combined with a certain amount of pressure. By this kind of massage the nutrition of the entire scalp is promoted, including the nerves, the capillaries, the rete mucosum, the hair follicles, the sudoriferous and sebiferous glands, and the muscles of the head and scalp. This massage, when properly carried out, exercises also a beneficial influence on the nutrition of the skull itself, and thus counteracts the tendency to atrophy of the parietal walls. It has great advantages over the energetic brushing of the hair and head which is recommended by many persons, and it has none of the disadvantages. The massage may be conveniently practised before the bath. Massage of the head, like other forms of self-massage, entails some exercise of the arms, hands and fingers, useful to those who do no manual labour. For more detailed management of the skin and hair I refer to Sir Malcolm Morris's chapter in "The Book of Health" [85].

XV.—THE SEXUAL SYSTEM—MARRIAGE.

The sexual system, though essential to the maintenance of the race, is less so to the prolongation of life. For this reason I had not given any space to it in former editions; but at the suggestion of friendly critics I now add a short chapter.

The conjugal union of husband and wife

forms the complement of man and woman one body and one soul, and in its purity is life's greatest happiness. Pure sexual union awakens the highest elements in man and woman and creates mental and physical health; but promiscuous debauch lowers the personal and public morality, and is the frequent source of venereal disease and premature death, mostly after much suffering. This is preventable and ought to be prevented. Chastity is the infallible preventive; but, as this is not always exercised, the State ought to find means to stamp out venereal disease. Sexual intercourse is not necessary to either man or woman. My experience has brought me in contact with a great number of persons who have abstained from it all their lives without impairment of health, and have lived to a happy and useful old age. I may also mention that in my youth I have been intimately associated with a small band of young men who recognized the unsatisfactory social position of women as compared with that of men, and especially so in regard to sexual relations. They considered it unjust that young, unmarried men were allowed to have free sexual intercourse with women without losing their position in society, while a young woman after such a lapse would be expelled from it. They, therefore, resolved to remain as chaste as they expected their future wives to be. I have reason to know that these men have carried out their resolution. All except one, who died early from tuberculosis, married between 23 and 38, and were happy as husbands and fathers, more so than the majority of those who had not abstained before marriage. If only men knew what they gain by chastity and what they lose by the want of it! Some judicious instruction on sexual matters ought to be imparted to children approaching adolescence.

It is not difficult to abstain, if the mind is inhibited from dwelling on erotic subjects. It requires a firm will, and this firm will to maintain chastity is also in other matters of life the most powerful aid to success and happiness. A person who is able to control himself in this matter will be able to control himself in others, and to overcome most of the difficulties in life. Great moderation ought to be exercised also in married life from adolescence onwards, but especially in advanced age. Serious harm often follows violation of this rule. I have repeatedly seen, when elderly men married young erotic wives, rapid loss of physical and mental power and the development of various chronic diseases and premature death. The term "moderation" has a different meaning to different persons; what is moderation to one is dangerous excess to another; but it may be said that if sexual cohabitation is followed by discomfort, pain, mental and physical depression, it must be regarded as excess. The sexual power gradually diminishes in all men with increasing years; there are, however, great differences in different men. Some men become impotent at the age of 40 and even earlier, others only after 70 or 80. As a rule, those who have been very moderate in the earlier periods of life retain their power longer. With some the desire ceases with the power, while in others the former continues and, if ungoverned, leads occasionally to sexual aberrations of old age which mar the happiness of the closing years of life. Here again the strong will must combat erotic thoughts, and the mind must be occupied with useful matters.

The most important point in the social side of the sexual question is marriage, which ought to be the source of happiness, health, and racial efficiency. Amongst some ancient nations marriage was considered a duty, and a fine was placed on celibacy. The duty of marriage was upheld in the middle ages, but in more recent times, with progressing civilization, or rather *luxury* and *selfishness*, celibacy has increased to a considerable extent. There are, however, States in which the unmarried and childless have to pay higher taxes than men who have to support a family, and justly so. With regard to the condition of individuals, my experience is that there is better health, less disease and greater happiness amongst married than unmarried persons, and that the proportion of persons living to old age is greater amongst the married. In the many very old persons whom I questioned on this point, scarcely 4 per cent. had never been married.

An all important point with regard to marriage is that we must endeavour by means of it to maintain the health and efficiency of the race. The principal inducements to marriage—love and convenience—ought not to be altogether neglected; but the health and improvement of the progeny, which is to the nation the material purpose of marriage, ought to receive the chief consideration. Gradually it must become acknowledged that it is the duty of the State to prevent the procreation of inferior, and to promote that of mentally, morally and physically superior, progeny. For this purpose marriages, and early marriages, of persons mentally, morally and physically sound, with good family histories, ought to be facilitated and even assisted, and those of tainted persons prevented as much as possible. Persons of weak constitution, criminals, inebriates, epileptics, the insane, and those heavily weighted with unfavourable heredity, ought not to be allowed to marry, nor ought those affected with syphilis, unless they can be regarded as perfectly cured. It would be out of place to enter fully into the much debated question of the limitation of the progeny of marriages, but I may be allowed to state as my experience, that if husband and wife are physically, intellectually and morally sound, the number of children to be desired ought to be fairly large, provided they can be satisfactorily brought up. Arrangements ought to be made that the expenses of education of the children of efficient but poor members of society are provided, partly or entirely, by the State or by the community. It is often stated that the health and beauty of wives is deteriorated by child-bearing, but my experience is rather to the contrary. A healthy woman under favourable circumstances gains, as a rule, physically and morally by having four to six children, if the intervals between the successive pregnancies are not less than eighteen to thirty months. Great restriction in the number of children not rarely injures the wife's health and happiness. "It has become fashionable for mothers not to nurse their children, but this is unnatural and wrong. Nature has endowed the woman with breasts for nursing; the right food for infants is the mother's milk, and it is the mother's duty to give it if there are no special obstacles. By nursing, the mother's love to her child is increased and the family happiness is enhanced. The father who has to work for a certain number of children and to bring sacrifices for their education, becomes through this a happier and more useful member of the nation than he who for selfish reasons avoids having children or restricts their number to one or two and neglects the duties of parenthood." It may be said that this matter has nothing to do with "prolongation of life," but it has, since the consciousness of doing one's duty causes a feeling of satisfaction and leads to happiness and health. The reader will find some important points of this question most judiciously discussed, in a contribution from Mrs. Gotto to the *Eugenic Review* [47A].

XVI.—THE GLANDULAR ORGANS, ESPECIALLY THE DUCTLESS OR ENDOCRINIC GLANDS.

Considerable additions to our knowledge have been made during the last fifty years by the attention paid to the functions of the *various glandular organs*, especially the so-called *ductless glands* and their internal secretions. What we know is as yet very imperfect, but clinical observation and experiment have already clearly demonstrated that these organs exercise vast influence on the metabolism, the development, and the health of the whole organism. This has been clearly proved with regard to *the thyroid and parathyroid glands*, the *pituitary body* or *hypophysis* of the brain, and the *adrenal* or *suprarenal glands*. The diseases and the extirpation of the thyroid and parathyroid glands produce remarkable changes in the nutrition of the whole body, and in the functions of the nervous, circulatory and cutaneous systems. As some morbid symptoms observed in old age seem to depend on senile changes in the thyroid system (Horsley

[56], Lorand [74], Léopold-Lévi [70A], G. R. Murray [88], and others), we must endeavour to maintain it as long as possible in an efficient state and prevent especially its atrophy. This consideration, and especially Kocher's observations on the excision of goitre, and the observations of Gull and Ord on myxœdema, led me to begin many years ago regularly to massage gently my own thyroid and parathyroid region, and to advise many of my patients showing a tendency to thyroidal atrophy to do so—a practice which has been attended with distinct benefit in several cases where symptoms akin to those of myxœdema had manifested themselves, such as puffiness of the face and hands, rapid falling out of hair, great dryness of the skin, diminution of body heat, mental hebetude and undue increase of weight. The massage of the thyroid and parathyroid region gradually led in a number of persons to amelioration, and this without the assistance of thyroid extract, although the use of the latter has produced a more rapid improvement in other similar cases. I must not, however, enter into this very important branch of organotherapy, since my little book is devoted to the maintenance of health and prevention of disease by general hygiene, including diet.

We are not able to massage the pituitary body and most other glands of the body as we can the thyroid and parathyroid, because most of them do not lie near to the surface. The glands situated in the abdominal cavity—the mesenteric glands, the spleen, the liver, the pancreas, the kidneys and suprarenal bodies—can be but very imperfectly massaged. Some beneficial influence, however, is effected by attention to general health, such as food and air and exercises (p. 246), and by the respiratory movements which have been previously mentioned, when combined with thorough compression of the abdomen during forced expiration.

We are still ignorant about the exact mode of action of the ductless glands and their secretions, but they seem to produce substances which have a remarkably stimulating influence on the metabolism of other organs, substances to which the name of *Hormones* has been given by Professor Starling, reminding one of Sir Almroth Wright's opinions. These hormones possess great power in preventing malnutrition and disease. If through injurious influences the functions of the endocrinic glands are deteriorated, the protective powers are weakened, and conditions of the body are brought about which are included in the term "run down." In such conditions we must endeavour to raise the nutrition of the endocrinic glands and the vigour of the body by food, by abundance of air, by appropriate mental and physical exercise, by change, by travel, by exhilaration and similar influences. If we do so before the decay is too far advanced, we often obtain most satisfactory results.

XVII.—THE SPECIAL SENSES.

The special senses exercise great influence on the nervous system and the whole organism through the impressions which they carry to them from without. They are apt to deteriorate with increasing years and in many families early decay is very prevalent. Our means for preventing this decay are very limited. By will power we can do much to prolong the functions of the muscles, the brain, the respiratory and digestive organs, but we can exercise scarcely any influence by our will on the special senses, although by carrying out the rules for maintaining the circulation and the nutrition of the whole body, and preventing infections, we benefit to some degree the special senses. By judiciously using the eyes and avoiding over-straining; as for instance, by reading in shaking railway trains and reading in imperfect light, we can somewhat prolong the maintenance of their functions, and thus postpone one of the greatest inconveniences of old age.

By the cold bath and active friction of the skin and thorough exposure to the open air in and out of the house, and by avoiding, as much as possible, infections, we can diminish the tendency to nasopharyngeal catarrhs and thus counteract a frequent cause of deafness, and also help to maintain the sense of smell, which latter may be assisted by taking a pinch of snuff once a day. But whatever we may do the special senses become blunted with old age. Fortunately the functions of the vital systems need not perish as early as those of the special senses; the intellect above all often outlives them, and we must try to be *content* with the faculties remaining to us.

XVIII.—PREVENTION OF DISEASE.

One of the essential means of preventing disease is the cultivation of the *resisting powers* of the body. We know that some persons may be exposed to infectious diseases and to other injurious influences without falling ill, and that other persons under the same conditions "catch" a disease. The former owe their safety principally to a strong resisting power, the latter owe their falling ill to a low resisting power. It is now generally acknowledged that there are arrangements in the body, especially in the blood, by which hostile bacteria entering the body are overpowered and thus rendered innocuous, if the defending elements are in a healthy condition. This forms a most important part of our resisting power, and we must endeavour to keep these protective agencies always in as perfect a condition as possible. We are frequently able to effect this by taking the appropriate quality and quantity of food; by a sufficiency of suitable exercise, including walking, breathing, sports and mental work; by spending daily several hours in the open air, and keeping the air in our rooms by day and night pure and without stagnation; by maintaining the skin in a healthy condition through baths, friction and massage; by attending to the healthy action of the intestines and by giving ourselves a certain amount of recreation and sleep. By these means, which are more fully explained in former chapters, we are likely to resist to a great degree infectious diseases and rheumatic and catarrhal complaints.

We must, however, not trust to our resisting power alone, but must avoid exposure to infection, a duty which is often neglected, even by most intelligent persons. I cannot enter here on the duties of the State and of the community to combat the spreading of infectious diseases, but I cannot refrain from saying that the registration of communicable diseases is absolutely necessary. This is being more and more recognized and must be acted upon; but also every single individual ought to consider it his duty not to expose himself to infection, and if himself infected, to avoid, as much as possible, every opportunity of carrying infection to others. This ought to be maintained not only with regard to the graver diseases, but also those generally regarded as milder affections. Sir Lauder Brunton, in his suggestive address on "Longevity and the Means of Attaining it" [18], justly directs attention to the great infectiousness of common colds and the duty of avoiding as far as possible the communication of them to others, especially to those who are weak either from disease or from old age; since a so-called common cold, which so many people consider a trifling matter, may under such circumstances, especially in very aged persons, become the cause of death. I have myself seen this repeatedly from common colds, and more frequently from influenza, which had been regarded as small matters. It is to a great degree in our power to prevent diseases of the digestive organs by the quantity and quality of our food and by proper attention to the action of the bowels (Section VII), and not less to be aimed at is the prevention of diseases of the circulatory and respiratory systems by means of air and exercise (Section VI).

The numerous syphilitic affections of the nervous and vascular systems can and ought to be prevented by avoiding the infection, and in the first line by chastity. In addition, however, education of the public, of teachers, and of the single individuals of both sexes, is absolutely necessary, as stated in Section XV.

The tendency to physical and mental decay in advancing years must be vigorously combated by means of keeping the brain and nervous system and all the organs of the body healthily exercised by mental and physical work; by not yielding to the inclination to idleness, to too much sleep and to over-rest. We must constantly think of the fact that in old age, unless we keep our organs in action they will rapidly decay. We must rouse our energy every day from early in the morning. To some, from having acquired good habits, this is easy; to others it is very difficult, "it goes against their nature," they say; but by fighting with all their might, by exerting their will not to succumb, it gradually becomes more easy, till at last a *good habit* is formed.

Some chronic diseases which cause premature senility and death cannot be perfectly cured when in an advanced stage, but their development can mostly be retarded and even entirely checked when attended to while still in an early stage. Thus, for instance, *arterio-sclerosis*, one of the most frequent causes of early death, cannot be cured when fully developed, but if the organic changes in the small blood-vessels are only in the beginning, manifesting themselves by occasional giddiness, confusedness, shortness of breath and palpitation on climbing staircases, much can be done by reduction in diet, especially fleshy food, avoiding mental and physical strain, hurry and excitement. For an important consideration in preventing disease I refer to the Section on Heredity (Section IV), where I have endeavoured to show that many life-shortening diseases which for generations have been hereditary in certain families can be counteracted by judicious régime. Experience often shows that persons who have inherited faulty constitutions, and have recognized this fact and wisely arranged their manner of living, reach great ages, while their strong but less prudent contemporaries succumb long before them.

One of the most important measures towards the prevention of disease and of injurious habits, and also towards promoting healthful influences, is *education*. We all must hail the steps which are being taken in schools to promote a general knowledge of hygienic influences such as cleanliness, diet and exercise; we must, indeed, insist on the duty of imparting some elementary knowledge about the maintenance of health, the prevention of disease and of spreading infectious diseases. A most necessary point in education is the teaching of temperance, especially with regard to alcoholic beverages, and the fearful consequences of intemperance, including the tendency to crime, and the destruction of the happiness and health of the family. Education, however, ought not to confine itself to the teaching of moderation and temperance, but ought to create *habits* for what is good and useful, such as work, obedience, self-control, veracity, unselfishness, helpfulness, so that they become almost instincts; and suppress those for evil, such as untruthfulness, carelessness, extravagance, procrastination, unpunctuality, idleness, self-indulgence, and dissipation, by constantly inhibiting the tendency to these vices. *Habits make or mar a man's life.*

It is often difficult to form good habits, and still more so to overcome bad ones. It is the first steps in either direction, in inhibiting the bad and forming the good, which require the intelligent use of a strong will and constant watchfulness from as early a period of life as possible. The mind of the young is much more pliable and retentive than that of the old, but the latter must never admit that it is too difficult or too late to form new good habits; a strong will must be victorious.

Amongst the weighty matters into which I am unable properly to enter is *clothing*. The clothes ought to retain the warmth of the body; to a certain degree they ought to keep it clean, and to cover it without being too tight, especially over the chest and abdomen, and too heavy, and ought to be varied according to the season and the different meteorological conditions. Tight clothing material keeps one less warm than loose, weight for weight. Two thin layers of clothes retain the warmth of the skin more than one thick one of the same weight. The clothes next to the skin ought to be absorbent, a quality which is well obtained by a loose material of wool, or linen or cotton or silk; loose woollen stuff is generally preferable, especially for rheumatics, to a dense layer of flannel.

It is essential to the maintenance of health, especially in very young children, old people, and all those whose vitality is lowered, to keep the skin warm. To the neglect of this rule many illnesses are due. If the temperature of the skin and the blood are lowered beyond a certain degree the protective power against some pathogenic bacteria is so much diminished that they get the upper hand and produce the corresponding disease. This is shown by everyday experience, and is explained by Pasteur's experiments on fowls in relation to anthrax (p. 259). As the decrease of the body heat is one of the main attributes of old age, one of the first duties of old people is to keep the body warm by day and night. The clothing, however, ought not only to keep the body warm, but it ought to be arranged in such a way that it allows free movement to every part of the body, that it does not, by pressure hinder the function of the organs of the chest and abdomen, as tight and badly arranged corsets do, or of the feet, as in the case of badly fitting boots, or of the veins of the legs (by tight garters), or, of those of the neck and head (by tight collars), &c. A matter often neglected is the advisability of keeping the feet dry. The socks and the boots or shoes ought to be changed whenever they get damp.

An equally important subject is the *house* or the rooms we live in, which ought to be light, airy and well ventilated, and ought to have a sunny aspect. The house, if in town, ought to lie in a broad street or an open place, exposed to the sun, not in a narrow street shut out from sun and air; if in the country, not in a hollow surrounded by high hills, or in a deep sunless valley, but on the brow or slope of a hill or ridge, with a southern aspect, well above the bottom, or in an open locality fully exposed to the sun. Almost entirely neglected is the utilization of the roofs of houses, where the air is very much better than in the lower parts of the houses, especially in towns. The roofs can be rendered safe and attractive by railings, awnings, comfortable couches, flowers and evergreens. I have availed myself of this whenever I had a chance, and marvellous was the improvement of invalids from spending the greater part of the day and occasionally the night on the open roof.

The resisting power of the body must be kept up by breathing exercises (p. 62), by open windows day and night, by the bath and friction of the skin, and by spending several hours every day in the open air. In the words of Lord Bacon "air accustomed consumeth less, but air changed nourisheth and repaireth more" [7].

Of great influence on the condition of the body is *climate*. This vast subject, too, we cannot adequately discuss. We must allude, however, to the old experience that a regular "change" for six to eight weeks every year from one part of the country to another, or to the seaside, or to the Continent, to different elevations above the sea, is a great help to mind and body, and through this, a powerful agent in the prolongation of life. The exact choice depends on the condition of the individual; if, for instance, the appetite and the digestion and the metabolism are to be increased, we select a locality with a dry, sunny, not too warm air, with a certain amount of wind of varying intensity (bracing); if we want to quiet an excitable nervous system often affected by sleeplessness, we choose a more humid but not actually damp air, combined with more equable temperature and only little wind (soothing). In some conditions a change from a windless to windy place is very useful; in others the opposite. Always, however, we must keep before our eyes that the locality selected ought to allow the aged or infirm person to be long in the open air and to take regular exercise. On some persons a stay at the seaside, or yachting, or a longer sea voyage, exercises the best influence; on others a stay in a warm, sunny and dry climate, such as Egypt; on others a fishing expedition; on others a walking tour; on others a stay in mountainous districts at various elevations, encouraging moderate climbing; on many persons the winter sports in the high Alps; for not a few travel from one place of interest to another is preferable to a long stay at the same place. *Travelling* is, in fact, a great promoter of longevity, especially by preventing premature senile decay.

"Haply, the seas, and countries different,
With variable objects, shall expel
This something settled matter in his heart."
—"Hamlet," III, 1.

The benefit of travelling is to a great degree due to the diversion of the traveller's thoughts from himself and his daily worries to new things and matters of general interest. Old people whose mental activity begins to be stagnant ought to go to localities where their attention is stimulated by art, by history, by scenery, and by the manners of the people, such as Egypt, Rome, Naples, Palermo, Florence, Venice, Athens, Constantinople, London, Paris, Vienna, Munich, Berlin, &c.

It ought to go without saying that in travelling it is necessary to avoid as much as possible draughts and dust and impure air in railway carriages; and that at most foreign places one has to be on one's guard against the risks of infection from drinking water, from food, and from unhealthy rooms.

With increasing years the resisting powers of the organism decrease, in some more and in others less, in some earlier, in others later. This circumstance requires our serious attention independently of the "change" discussed above. While in youth and in the prime of life cold winters and the cold air of high elevations exercise a most bracing influence, and the dampness, the high winds, the fogs and mists of our ordinary winters are fairly well borne, they cause in many old people, whose heat-producing power is much diminished and who are very sensitive to low temperatures (especially those who neglect regular open-air exercise and open windows), many ailments such as catarrhal affections, bronchitis, rheumatism, mental depression and other troubles, and through these lead to premature senile decay and death. Cold air also causes contraction of the peripheral small arteries, and through this a rise in the blood-pressure; hence an increase of deaths from apoplexy in cold winters, particularly at high elevations. Warming the dwelling-rooms, the passages of the house, the water-closets, and adopting warmer clothing are useful precautions, but are often insufficient to counteract the meteorological inclemencies. It is therefore prudent for many of those who have lost much of their resisting power, to spend the colder months in milder climates, where their powers of accommodation are less tried, such as the south and south-west of England and Ireland, and still more so the French and Italian Rivieras, Costabelle, Cannes, San Remo, Nervi, &c., especially the drier and higher places like Grasse, where, owing to the greater dryness of the air and the large proportion of sunshine, chronic rheumatism, a frequent trouble of the aged, is much relieved, where the appetite, the inclination and power to take active exercise, are increased, and through this the muscular, the circulatory and the digestive systems are maintained in a fairly vigorous condition. In the south-west of France, Pau and Arcachon have advantages, and also Biarritz, although it must be owned that the last is rather too windy for the aged. In Spain, Malaga and Algeciras deserve to be mentioned. Egypt, Algiers, Madeira, the Canary Islands, Corsica and Corfu can only be recommended to those who, in spite of advanced years, have remained good travellers, and especially good sailors. The large amount of sunshine in these localities, the longer duration of daylight during the winter months, and the subtropical vegetation, cheer the mind and render it more hopeful; and hope and cheerfulness exercise, we know, a most beneficial influence on the whole body. The first *Lord Brougham* showed his wisdom in this matter by spending the winters of his later life at Cannes, where he enjoyed much better health and prolonged his life considerably.

With regard to the harmfulness of *cold* (low temperature of the air), slight when combined with stillness of air, but great when combined with high wind, Sir Lauder Brunton directs attention to an ingenious experiment by Pasteur, "who discovered that fowls, the natural temperature of whose body is nearly 104° F., are immune from anthrax, but if they are made to stand with their legs in cold water until the temperature of their blood is sufficiently lowered, they become susceptible to the disease." We know that we often carry with us in the mouth, in the nose, and in other parts of the body, the germs of diseases, without becoming actually infected by the diseases themselves while we are in robust health, but that when our vitality is lowered by exposure to cold, we become apt to take the disease. Our experience of every day shows this, especially with regard to pneumonia, influenza, so-called "colds," &c. We know, also, from numerous observations, that persons feeble through age, or on account of preceding disease, or owing to weak constitution, are depressed in their assimilating, nervous and muscular functions by continued low temperature, and under such circumstances frequently fall victims to pneumonia. Pasteur's above-cited experiment helps us to explain these observations.

XIX.—RECAPITULATION.

There are many other subjects which deserve discussion, but I trust that, if the suggestions I have ventured to make are acted upon, with adaptation to the different conditions of persons and environments, the life of the individual will be prolonged, and that in the course of generations a habit of living judiciously will be created and transmitted from parents to children, and that the duration of human life will gradually be raised in a much larger number of cases to its normal term, viz., about 100 years; and I further hope with Sir J. Crichton-Browne, Sir Lauder Brunton and others that not only the duration of life but also its usefulness will be prolonged, and its happiness increased, and that it may be terminated by natural old age and death coming sleep-like without suffering. I also expect that in the course of centuries, together with the physical, also the mental development of man will make further progress, and that he will be able to understand many things and conditions which are at present obscure to him. The pessimistic view so often expressed, that the human race is deteriorating, will be disproved; the type of man will, on the contrary, be raised physically as well as morally.

will close this discourse by summing up some of the more important advice recommended in it:—

(1) To maintain the vigour of every organ, and the resisting power of the whole body, by regular daily walks, rides, respiratory and other exercises (Section VI), and mental work (pp. 187 ff.).

(2) To spend daily several hours in the open air, and keep the air in the house pure and dry and in motion by open windows, by fireplaces and other means (Section VI).

(3) To practise moderation in eating, drinking, and all bodily enjoyments (pp. 17, 119, 175, 205).

(4) To prevent disease and to counteract the inherited tendencies to various diseases (pp. 22 ff., 245 ff.).

(5) To create, as far as possible, the habit of going early to bed, and of rising early, and to restrict the hours of sleep, in adult life, to six, or seven, and only exceptionally eight (p. 225.)

(6) To promote a healthy condition of the skin by the daily bath or cold rub and friction (pp. 227-228).

(7) To cultivate sympathy, equanimity, contentedness, cheerfulness and hopefulness; and the great power of the will towards pursuing the path of duty and controlling anger, vanity, envy, jealousy, undue ambition, *and all other passions* (pp. 201 ff.).

Shakespeare puts strikingly some of these rules into the mouth of the old servant Adam in "As You Like It"

"Though I look old, yet I am strong and lusty ;
For in my youth I never did apply
Hot and rebellious spirits in my blood,
Nor did not with unbashful forehead woo
The means of weakness and debility,
Therefore my age is as a lusty winter,
'Frosty but kindly."

Act II, Sc. 3.

XX.—BIBLIOGRAPHY.

(The number of works on old age, prolongation of life, and matters influencing them, such as food, exercise and the whole manner of living, is so large that many important works are omitted.)

[1] Acland, T. D. "Hours of Sleep at Public Schools." *Lancet*, 1905.

[2] Allbutt, Sir Clifford, K.C.B. "Senile Plethora." *Hunterian Soc. Trans.*, Session 1895-6.

[3] *Idem.* "Rise of Blood-pressure in Later Life." *Roy. Med. Chir. Soc. Trans.*, 1903, vol. lxxxiii.

[4] *Idem.* "The Prevention of Apoplexy." *Bristol Med. Chir. Journ.*, March, 1905.

[4A] *Idem.* "Diseases of the Arteries, including Angina Pectoris." London, 1915, 2 vols.

[5] Allchin, Dr. W. H. "Senility." Quain's "Dictionary of Medicine," Second Edition, 1894.

[6] Bacon, Roger. "The Cure of Old Age" and "The Preservation of Youth." London, 1683. (*De Prolongatione Vitæ.*)

[7] Bacon, Lord. "Historia Vitæ et Mortis." *Opera Omnia*, 1665.

[8] *Idem.* "Essays on Counsels, Civil and Moral." London: David Scott, 1890.

[9] Baeumler, Prof. Ch. "Ist Arteriosklerose eine Allgemeine Krankheit?" *Berl. klin. Wochenschr.*, 1905.

[9A] *Idem.* "Altes und Neues über das Altern und über Lebensverlängerung." *Deutsch. Med. Wochenschr.*, Berlin, 1916, xlii, pp. 762, 792.

[11] Barlow, Sir Thomas, M.D. "On Cases described as Acute Rickets which are probably a combination of Scurvy and Rickets." *Med. Chir. Transactions*, London, 1883, vol. lxvi.

[12] *Idem.* "Scorbut Infantile." Extrait du Traité des Maladies d'Enfance, Paris, tome ii, 1897.

[12A] Biedl, A., M.D. "Innere Sekretion." Urban and Schwarzenberg, Berlin and Wien, 1910.

[14] Brunton, Sir T. Lauder. "Influence of Stimulants and Narcotics on Health." "The Book of Health," p. 183. London: Cassell and Co., 1883.

[15] *Idem.* "On Atheroma." *Lancet*, October, 1895.

[18] *Idem.* "An Address on Longevity and the Means of Attaining it." *Lancet*, November 17, 1906.

[21] Campbell, Dr. Harry. "Observations on Mastication." *Lancet*, 1903, vol. ii.

[22] *Idem.* "Respiratory Exercises in the Treatment of Disease." London, 1898.

[23] *Idem.* A Lecture on the Natural Food of Man. *Polyclinic*, April, 1907.

[23A] Carr, J. Walter, M.D. "How to Live Long." London: Methuen and Co.

[23B] Cavanagh, Francis, M.D. "Care of the Body." London: Methuen and Co.

[24] Charcot, J. M. "Leçons cliniques sur les maladies des vieillards." Second Edition, 1874.

[25] Cheyne, Dr. George. "Essay on Health and Long Life." Fifth Edition, London, 1725.

[26] Chittenden, Russell K. "Physiological Economy of Nutrition." New York, 1904.

[27] Cicero. "On Old Age," with the "Books of Offices." Translation by Cyrus R. Edmonds. London, 1901.

[28] Collective Investigation Committee of the British Medical Association (Report prepared by Dr., now Sir Isambard Owen). *Brit. Med. Journ.*, 1888, vol. i.

[29] Cornaro, L. "Discourses on a Sober and Temperate Life." English translation, 1768. Original Italian Editions, 1558 and 1620.

[30] Crichton-Browne, Sir J. "Education and the Nervous System." "The Book of Health," p. 209. London: Cassell and Co., 1883.

[31] *Idem.* "Old Age." *Brit. Med. Journ.*, October 3, 1891.

[32] *Idem.* "The Prevention of Senility." *Journ. Prev. Med.*, August, 1905.

[33] *Idem.* "Parsimony in Nutrition." *Journ. of the Inst. of Public Health*, 1808, pp. 487 ff. and 527 ff.

[34] Dryden, John. "The Works of John Dryden." Edited by Walter Scott, Esq. London, 1808.

[35] Duckworth, Sir Dyce, and Hutchison, Dr. R. "Dietetics." Allbutt and Rolleston's "System of Medicine," Second Edition, 1895, vol. i.

[36] Dukes, Dr. Clement. "The Essentials of School Diet," 1891.

[38] Edie and Simpson. "The Preparation of Various Foodstuffs (especially Wheat and Rice)." *Brit. Med. Journ.*, June 17, 1911.

[43] Ewart, W. "Longevity, and the Means of Attaining it." *Lancet*, December 1, 1906.

[43A] Eykmann, "Beriberiähnliche Krankheit der Hühner," *Virchow's Archiv*, 1897, pp. 148, 523.

[44] Finot, Jean. "La Philosophie de la Longévité." Paris, 1908.

[45] Fletcher, Horace. "The A, B—Z of Nutrition." New York, 1894.

[46] Flourens, J. P. "On Human Longevity," &c. 1855. Translated from the Second French Edition, "De la longévité humaine."

[46A] Fraser and Stanton. "The Etiology of Beriberi." Studies from the Institute of Medical Research. 1911.

[46B] Funk, C. "Die Vitamine." Wiesbaden: Bergmann, 1914.

[46C] Galenus Claudius. "De Sanitate Tuenda Libri VI."

[46D] Gould, Sir Alfred Pearce. "Alcohol and War," in the "Drink Problem of To-day." (67A).

[47] Goldscheider, Prof. D. "Hygiene des Herzens." *Veröffentlichungen d. deutschen Vereins f. Volkshygiene*, 1905.

[47A] Gotto, Mrs. O. B. "The Eugenic Principles in Social Reconstruction," in the *Eugenics Review*, vol. ix, No. 3.

[49] Haig, Dr. A. "Diet and Food," &c. London, 1902.

[50] *Idem.* "Uric Acid as a Factor in the Causation of Disease." Sixth Edition, 1903.

[50*] Hall, I. Walker. See under Walker Hall [130].

[50A] Halliburton, Dr. W. D. "Annual Report of the Progress of Chemistry," 1907.

[50B] *Idem.* "Handbook of Physiology." Twelfth Edition. London: John Murray, 1915.

[50c] Hertz, A. F. Lectures on the Passage of Food through the Human Alimentary Canal. *Brit. Med. Journ.*, 1908, vol. i, p. 130.

[51] Hill, Leonard, F.R.S. "An Address on the Influence of Muscular Exercise and Open Air on the Bodily Functions." *Brit. Med. Journ.*, September 12, 1912.

[52] Hill, L., and Flack, M. "On the Nutritive Value of Flours."

[53] Hindrede, M. "Untersuchungen über die Verdaulichkeit einiger Brodsorten." *Zeitschr. f. physikal. u. diätetische Therapie*, February, 1913, vol. xxvii.

[54] Hirschfeld, F. "Nahrungsmittel und Ernährung." Berlin, 1900.

[55] Holland, Sir Henry. "Human Longevity." Essays. Longmans, 1862.

[55A] Hopkins, F. G. "Diseases due to Deficiencies in Diet." *Lancet*, 1913, vol. ii, p. 1309.

[56] Horsley, Sir Victor. "On the Thyroid and Pituitary Bodies" (Brown Lectures, 1884). *Brit. Med. Journ.*, February, 1890.

[58] *Idem.* "The Effect of Alcohol on the Human Brain." *Brit. Journ. of Inebriety*, October, 1905.

[59] Hufeland, Christoph W. "The Art of Prolonging Life." Translated from the German. London, 1797. The original German edition was entitled "Makrobiotik, oder die Kunst das menschliche Leben zu verlängern" (1796).

[60] Humphry, Prof. (Sir George Humphry). "Old Age." Cambridge, 1889.

[61] Hunt, Dr. R. "The Effects of a Restricted Diet and of Various Diets upon the Resistance of Animals to Certain Poisons." Bulletin No. 69, Hygienic Laboratory, Public Health Service, U.S., Washington, 1910, p. 93.

[62] Hutchison, Dr. Robert. "Food and the Principles of Dietetics. Fourth Edition. London, 1916.

[63] *Idem.* "Some Dietetic Problems." *Proc. Roy. Inst.*, 1907, vol. xviii, p. 269.

[63A] Jacobi, A. Introduction to Nascher's "Geriatrics," [88A]

[64] Jeandelize, P. "Insuffisance thyroidienne et parathyroidienne." *Rev. Neurol.*, Paris, 1903, p. 258.

[65] Johnson, Dr. Jossé. "Longevity: Race or Environment." Transactions of the Life Assurance Medical Officers' Association, London, February, 1910.

[66] Kant, Immanuel. "Von der Macht des Gemüths durch den blossen Vorsatz seiner Krankhaften Gefühle Meister zu werden." *Journ. der pract. Aerzneykunde*, Jena, 1788, vol. v.

[67] Keith, Dr. George. "Plea for a Simpler Life." 1896.

[67A] Kelynack, T. N. "The Drink Problem of To-day." Methuen and Co., 1916.

[68] Koenig, T. "Chemische Zusammensetzungen der menschlichen Nahrungs- und Genussmittel." Vierte Auflage, 1903.

[69] Kraepelin, Prof. E. "Der Alkohol in München." *Sitzungsberichte des aerztlichen Vereins München*, 1901.

[70] Lankester, Sir E. Ray. "Comparative Longevity." London, 1870.

[70*] Laurentius, Andreas. "A Discourse of the Preservation of the Sight, and a Treatise of the Melancholike Diseases, of Rheumes, and of Old Age," translated by Richard Surphlet. London, 1599.

[70A] Léopold-Lévi. "Thyroid Insufficiency." *Practitioner*, February, 1915.

[71] Leyden, Prof. E. von. "Allgemeine Therapie der Ernährung." "Handbuch der Ernährungstherapie," 1897, pp. 217 ff.

[73] Lindheim, Alfred von. "Saluti senectutis." Leipzig und Wien, 1909.

[74] Lorand, Dr. Arnold. "Das Altern." Leipzig, 1909.

[74A] Lusk, Graham. "The Fundamental Basis of Nutrition." New York: Yale University Press, 1914.

[75] Macalister, C. J. "The Personal Factor in the Diet." *Lancet*, December 28, 1907.

[75A] Macfie, R. C. "Air and Health." Methuen and Co.

[76] Mackenzie, Sir James. "The Oliver-Sharpey Lectures on Heart-failure." *Brit. Med. Journ.*, April, 1918.

[76A] Mead, Richard. "The Medical Works." New Edition. Edinburgh, 1775.

[80] Metchnikoff, Prof. Elie. "Etudes sur la nature humaine." Paris, 1903. (English Edition, "The Nature of Man." By P. C. Mitchell, F.R.S. London, 1904.)

[81] *Idem.* "The Prolongation of Life." English Translation by P. C. Mitchell, F.R.S. London: Heinemann, 1907.

[82] *Idem.* "Etude sur la Vieillesse (Essais optimistes)." Paris, 1907.

[83] Michels, Dr. E. and Weber, Dr. F. Parkes. "Obliterative Arteritis leading to Gangrene of Extremities," &c. *Trans. Path. Soc. Lond.*, 1905, vol. lvi, pp. 223—230.

[84] Mitra, S. M. "Hindu Exercises for making the Body supple." *Morning Leader*, London, April 12, 1909.

[85] Morris, Sir Malcolm. "The Skin and Hair." "The Book of Health," p. 863. London: Cassell and Co., 1883.

[86] Mosso, Prof. Angelo. "Sulla circulazione del sangue nel cervello dell' Uomo." Roma, 1880.

[86A] *Idem.* "Fatigue." Translated by Margaret Drummond and W. B. Drummond. London, 1915.

[87] Murphy, Sir Shirley F. "Health at Home." "The Book of Health," p. 589. London: Cassell and Co., 1883.

[88] Murray, Dr. G. R. "Diseases of the Thyroid Gland." London, 1900.

[88A] Nascher, L. L. "Geriatrics: Diseases of Old Age and their Treatment." With an Introduction by A. Jacobi. Philadelphia: P. Blakiston and Son.

[89] Naunyn, Prof. B. "Allgemeine Pathologie und Therapie," in Prof. Schwalbe's "Greisenkrankheiten." Stuttgart, 1909.

[90] Noorden, Prof. Carl von. "Lehrbuch vom Stoffwechsel." 1896.

[91] *Idem.* "Metabolism and Practical Medicine." Edited by Walker Hall. London, 1907.

[92] *Idem.* "Ernährungstherapie bei Stoffwechselkrankheiten." Von Leyden's "Ernährungstherapie." Leipzig. 1897.

[93] Oertel, Prof. "Therapeutics of Circulatory Derangements." Ziemssen's "Handbook," vol. vii, 1885.

[94] Oliver, Dr. G. "Recent Studies on Tissue Lymph Circulation" (Oliver-Sharpey Lectures). *Lancet*, 1904, vol. i.

[96] *Idem.* "Studies on Blood and Blood-pressure." Second Edition. London, 1908.

[97] Ormstein, Bernhard. "Makrobiotische Berichte aus Griechenland." *Virchow's Archiv*, 1891, vol. cxxv, p. 464.

[97A] O'Shea and Kellogg. "Making the Most of Life." The Macmillan Co., New York, 1915.

[98] Osler, Sir William. "Valedictory Address at Johns Hopkins University." *Journ. Amer. Med.*, March, 1905.

[99] *Idem.* "A Way to Live." An Address to Yale Students. London: Constable, 1913.

[99A] *Idem.* "Angina Pectoris and Allied States." 1897.

[100] Oswald, Dr. A. "Die Schilddrüse und ihr wirksames Princip." *Biochem. Centralbl.*, Berlin, December, 1902.

[101] Owen, Sir Isambard. "Report on the Enquiry into the Connection of Disease with the Habits of Intemperance." *Brit. Med. Journ.*, 1888, vol. i.

[102] Parkes, E. A. "A Manual of Practical Hygiene." Fifth Edition, 1878.

[103] Pavlov, Prof. J. R. "The Work of the Digestive Glands." Translated by Dr. W. H. Thompson. Second Edition. London, 1910.

[104] Pel, Prof. P. K. "Ueber die Kunst gesund und glücklich zu leben und Krankheiten zu verhüten." 1902.

[106] Pflüger, Prof. E. F. W. "Die Kunst der Verlaengerung des menschlichen Lebens." Bonn, 1890.

[107] Pollock, Dr. James E. "The Influence of our Surroundings on Health." "Book of Health," 1883, p. 519 ss.

[108] Powell, Sir R. Douglas. "Advanced Life and its Diseases." *The Hospital*, February 13 and 20, 1909.

[108A] Rabagliati, Dr. A. "The Influence of Height and Weight on the Mortality of Insured Persons." *Transactions of the Assurance Medical Society*, London, 1915, pp. 137 *et seq.*

[109] Reports, Detailed Annual, of the Registrar-General of Births, Deaths and Marriages in Scotland for 1903, 1904 and 1905. Glasgow, 1906, 1907, 1908.

[110] Rodella, A. "Studien über Darmfäulniss." *Wiener klin. Wochenschr.*, 1910. No. 23.

[111] Roettger, Prof. H. "Lehrbuch der Nahrungsmittelchemie." Third Edition. Leipzig, 1907.

[111A] Rolleston, Sir H. D. "Diseases of the Liver, &c." Second Edition. 1912.

[112] Rubner, Prof. M. "Physiologie der Nahrung und der Ernährungstherapie." Leipzig, 1897.

[113] Russell, Hon. R. "Strength and Diet." Longmans, 1905.

[113A] Sanctorius Sanctorius, "Medicina Statica." Englished by J. D. 1676. The original edition of his "Ars de Statica Medicina" was published in 1614.

[114] Saundby, Dr. Robert. "Old Age: its Care and Treatment." London, 1913.

[115] Savill, Dr. T. D. "Old Age in Health and Disease." *Med. Soc. Trans.*, London, 1897, vol. xx.

[117] Sawyer, Sir James. "Insomnia," in "Practical Medicine." Fifth Edition. 1912.

[118] Schmidt, Prof. A. "Zur rationellen Behandlung d. chron. habit. Obstipation." *Münch. Med. Wochenschr.*, 1905, p. 1970.

[119] Schwalbe, Prof. T. "Greisenkrankheiten." Stuttgart, 1909.

[120] Sinclair, Sir John. "Code of Health and Longevity." Fifth Edition. London, 1833.

[121] Snyder, Harry. "Human Foods and their Nutritive Value." New York: The Macmillan Company, 1908.

[121A] Sohn, Charles E. "Nutrition." London: H. Kimpton, 1914.

[122] Taylor, J. Maddison, M.D. (of Philadelphia). "The Conservation of Energy in those of Advanced Years." *Popular Science Monthly*, February, 1904.

[123] *Idem.* "How to Postpone the Degenerative Effects of Old Age." *Journ. Balneol. and Climatol.*, October, 1904.

[123A] Temple, Sir Wm. "The Works of Sir W. T.," vol. iii, 1757, "Of Health and Longevity."

[124] Thom, W. "Human Longevity: Its Facts and Fictions." 1873.

[125] Thompson, Sir Henry. "Diet in Relation to Age and Activity." Warne, 1901.

[126] Treves, Sir Frederick. "The Influence of Dress on Health. "The Book of Health," p. 461. London: Cassell and Co., 1883.

[128] Voit, C. von. "Handbuch der Physiologie des Allgemeinen Stoffwechsels." Leipzig, 1881.

[130] Walker Hall. "The Purin Bodies of Foodstuffs." Second Edition. 1903.

[131] Watson, Dr. Chalmers. "The Influence of an Excessive Meat Diet on the Osseous System." *Lancet*, December 8, 1906.

[132] *Idem.* "Book of Diet." London: Nelson.

[133] Weber, Dr. F. Parkes. "Visceral Scleroses and Relative Over-Nutrition." *Treatment*, London, 1898, vol. ii, No. 9, pp. 257—259.

[134] *Idem.* (Jointly with Dr. Michels). "Obliterative Arteritis," &c. *Trans. Path. Soc., Lond.*, 1905, vol. lvi, pp. 223—230.

[135] *Idem.* "The Physiology and Pathology of Old Age." Allbutt and Rolleston's "System of Medicine," Second Edition, vol. i, 1905, pp. 181—196.

[135A] *Idem.* "Diseases in their Relation to Obesity," Paper read at the Assurance Medical Society, London, January 5, 1916, *Medical Press*, 1916, vol. 152, pp. 119—121. Cf. *Idem.* "Fatness, Overweight, and Life Assurance," *Proceedings of the Life Assurance Medical Officers' Association*, London, 1901, pp. 113—124.

[136] Weber, Sir Hermann. "On the Hygienic and Therapeutic Aspects of Climbing." *Lancet*, October, 1893.

[138] *Idem.* "Prevention of Premature Old Age and Prolongation of Life to its Natural Term." Allbutt and Rolleston's "System of Medicine." Second Edition, vol. i, 1905, pp. 197—211.

[140] Weir-Mitchell, Dr. S. "Wear and Tear." Fifth Edition. Philadelphia, 1891.

[141] Weissmann. "Ueber die Dauer des Leben." 1882.

[142] Whitaker, Sir Thomas P., M.P. "Alcoholic Beverages and Longevity." *Contemporary Review*, March, 1904.

[143] Wilks, Sir Samuel. "On the Correction of Hereditary Tendencies." *Lancet*, October, 1903.

[144] *Idem.* "De Senectute." *Lancet*, December 2, 1905.

[144A] Williams, Leonard, M.D. "Minor Maladies and their Treatment." Fourth Edition. Baillière, Tindall and Cox, 1918.

[145] Wood, Dr. Neville. "The Treatment of Constipation and Colitis by Paraffins and Agar." *West Lond. Med. Journ.*, April, 1906.

[146] *Idem.* "Health Resorts of the British Islands." London, 1912.

[146A] Woodhead, G. Sims. "The Pathology of Alcoholism," in "The Drink Problem" [67A], pp. 33 to 82.

[149] Young, T. E. "Centenarians." 1902.

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